Canada. Mines and Technical Surveys, Dept. of. Geographical Branch

Taiwan (Formosa), a geographical appreciation.

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS
GEOGRAPHICAL BRANCH

TAIWAN
(FORMOSA)

A GEOGRAPHICAL APPRECIATION

FOREIGN GEOGRAPHY INFORMATION SERIES
No. 5

PRICE: FIFTY CENTS

OTTAWA, CANADA
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Preface

This report on Taiwan (Formosa) is the fifth in the series of foreign geography reports produced by the Geographical Branch, Department of Mines and Technical Surveys in order to "make readily available geographical data about ..... foreign areas of importance to this country."

Taiwan may well become a major point of interest in the Far East. This report is designed to acquaint Canadians with the extent and limitations of Taiwan's human and material resources considered in the light of its cultural achievements.

Generalizations and omissions have had to be made. However, this report may be amplified by reference to selected textual and map references described in the bibliography.

This report was prepared in the Foreign Geography Research division of the Geographical Branch by Benjamin Shindman. Maps and illustrations were completed under the supervision of Paul H. Laurendeau. The overall preparation of the report was supervised by George A. Bevan.

J. Wreford Watson,
Director, Geographical Branch.

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INTRODUCTION

Taiwan is one of the many heavily-populated islands in the Pacific off the Asiatic coast. Relatively speaking it is not one of the more important islands, being overshadowed in the world political and economic spheres by Japan, the Philippines and Java. Recent events have, however, brought a new focus to bear on the island.

Taiwan's Position Relative to Asia

Off the eastern coast of Asia lie the mountainous island arcs of the Pacific. The island chain closest to the continent marks the edge of the Asiatic continental shelf. Taiwan is one of the islands in this chain. The island is tropical in nature with its shores bathed by the warm waters of the Kuro Siwo ocean current. Latitudinally it lies athwart the Tropic of Cancer. This is reflected in the economic geography of the island. Because of its climate at least two crops can be grown each year everywhere on the island and in the south even three crops can be raised. In area it totals 13,836 square miles, two-thirds the size of Nova Scotia, and on it live approximately eight million people. About 70% of the island is covered by heavily wooded, high, rugged mountains. More than 70 peaks attain heights exceeding 7,500 feet with Mt. Morrison at an elevation of 13,145 feet being the highest point. Because of these mountains the density of population on the lowlands, where over 95% of the people live, is comparable to the areas of densest population in China and Java.

The island, trending north/south, is roughly cigar-shaped being about 250 miles long and 90 miles wide at its broadest point. No part of Taiwan is more than 50 miles from the sea. Some 100 miles westward across the Taiwan Strait lies the coast of China. North and east of the island stretch the Ryukyu Islands, stepping stones to Japan Proper some 800 miles from Taiwan. To the south the Batan and Babuyan Islands lead to the Philippines. The north shore of Luzon is only about 250 miles from the Koshun Peninsula, Taiwan's southernmost extremity. In ancient days Taiwan, like most of the islands of the Pacific chains, lay off the beaten track of Asiatic folk movements. Its inhospitable shores, with their lack of good harbours, precluded visits from all but the most adventurous. Today in the age of the aeroplane, when hardly any part of the world is thought to be remote, Taiwan is no longer considered off the beaten track for it is but a few minutes flight by jet-plane from China and a few hours from the Philippines, Japan and Southeast Asia. (Figure 1)

Although off the beaten track in years gone by Taiwan has been successfully invaded a number of times. The first known invasion is thought to have occurred several centuries B.C. when a strain of people known as Longkius reached the island. During the second half of the 6th Century A.D. Malay peoples from the Philippines reached the island by migrating along the route of the Kuro Siwo. These fierce head-hunting Malays soon replaced the Longkius. Descendants of both these peoples still inhabit the relatively inaccessible mountainous regions of the island.

Taiwan was first mentioned in history in 605 A.D. when Ho Man, a Chinese navigator reached the island and claimed its territory for the Sui

dynasty. Chinese demands on the Malays for recognition of their emperor and for payment of tribute were effectively denied by the Malay peoples. After burning a few coastal villages the Chinese retired from the island for almost a thousand years. During the 14th and 15th Centuries some Chinese migrated to Formosa from the mainland and settled along the south-west coast.

In the 15th and 16th Centuries Japanese pirates operating in Chinese waters caused a break in economic relations between China and Japan. Formosa thereupon became an entrepôt through which these two nations traded. Towards the end of the 16th Century two Japanese expeditions of conquest ended in failure. During this period of world history the nations of western Europe discovered and began to exploit the sea routes to the Far East. In the next century, the 17th, their trading stations began to dot the coasts of monsoon Asia.

The Portugese, the first Europeans to visit the island, named it Formosa. They and the Spanish made several unsuccessful attempts to establish trading colonies on the island.

In 1623 the Dutch built a fort and trading post at Anping (now part of Tainan). Both the Spanish and the Dutch occupied a trading station at Tansui for a short time. The island coasts, in the meantime, had become the home waters for pirates of many nationalities - Japanese, Chinese, Dutch, Portugese, etc. Refugees and partisans of the Ming dynasty, fleeing the armies of the Manchus, migrated from the mainland in 1661. They were led by Koxinga, the son of a Formosan pirate chief of Japanese descent. Within a year the Dutch were expelled from their fort at Anping and piratical raids on the Chinese coast were begun.

In 1682, however, the Chinese on Taiwan acknowledged the suzerainty of the Manchu Emperors and Taiwan became part of the coastal province of Fukien. In spite of this, mainland control was only nominal for the next two centuries. The Chinese then successfully drove the Malays from most of the lowland areas which were suitable for agriculture. The majority of these immigrants from the time of Koxinga to the beginning of the 19th Century were Hakkas - rugged independent wanderers and landless men from South China. During the 19th Century the majority of the Chinese immigrants were peasants from Takien and Kwantung.

When China was forced to trade with the world by the Treaty of Tientsin in 1858 two of the treaty ports were located on Taiwan - Tansui, the river port for Taipei, and Tainan. Traders and missionaries followed the opening up of the island to international trade. Ever since the Chinese had begun to settle on the island they had waged continual war with the Malay tribes. It was a warfare reminiscent of the western frontier of the United States during the period of the Indian Wars. When ships were wrecked along the shores of Taiwan those mariners who fell into the hands of the Malay head-hunters were immediately slaughtered. The murder in this way of a ship-wrecked Japanese crew in 1871 resulted in the despatch three years later of a Japanese punitive expedition to the Koshun Peninsula, where the incident had occurred. The Japanese expedition defeated the tribesmen and remained in occupation of some territory until an indemnity had been paid by the Chinese government.

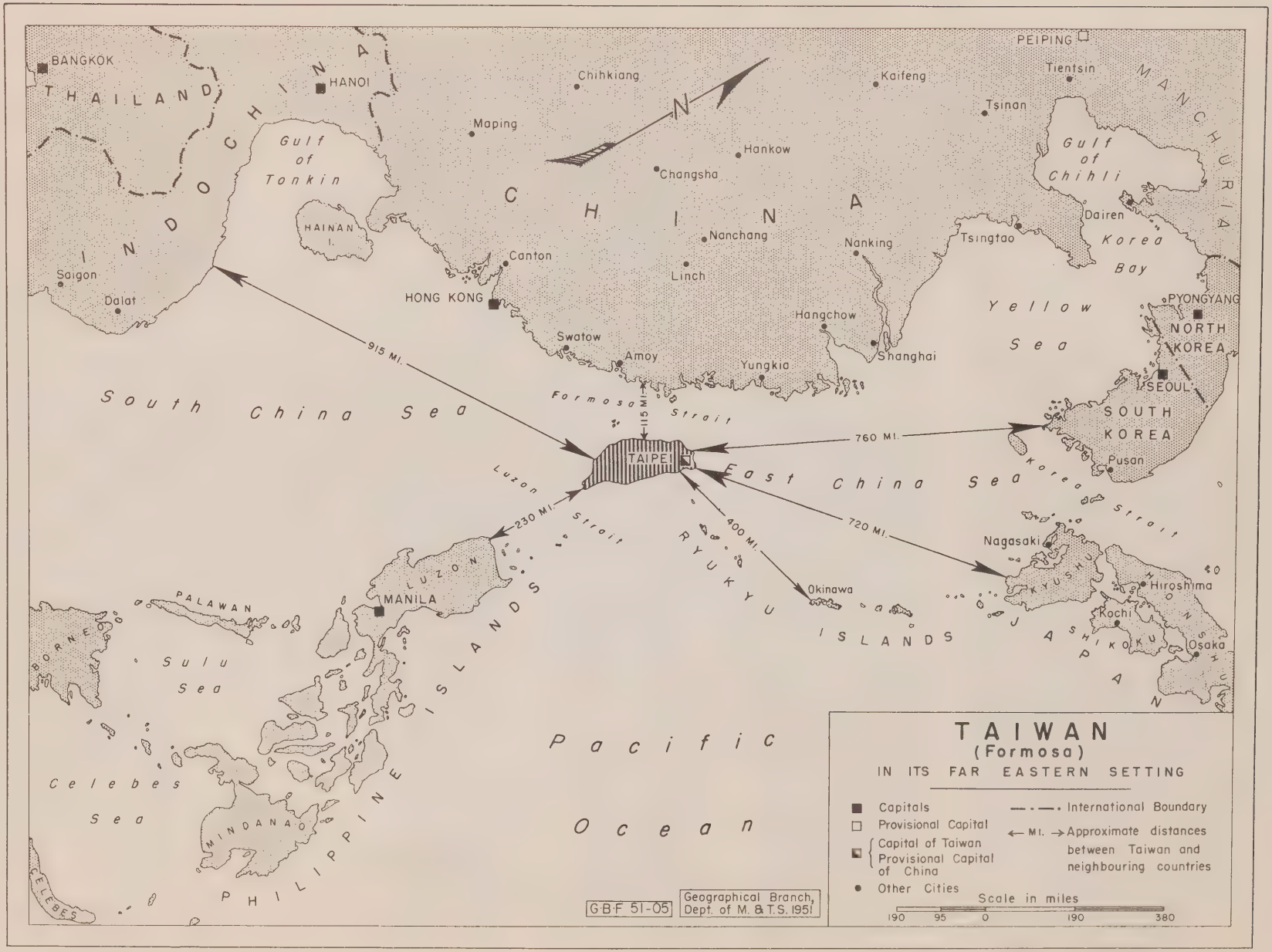
BANGKOK
THAILAND
INDOCHINA
HANOI
Gulf of Tonkin
HAINAN I.
Saigon
Dalat
Maping
Chihkiang
Kaifeng
PEIPING
Tientsin
MANCHURIA
Tsinan
Gulf of Chihli
Hankow
Changsha
CHINA
Nanchang
Nanking
Tsingtao
Dairen
Korea Bay
Canton
Linch
HONG KONG
Yellow Sea
PYONGYANG
NORTH KOREA
Hangchow
Swatow
Amoy
Yungkia
Shanghai
SEOUL
SOUTH KOREA
915 MI.
South China Sea
115 MI.
Formosa Strait
760 MI.
TAIPEI
Pusan
Luzon Strait
East China Sea
Korea Strait
230 MI.
400 MI.
720 MI.
Nagasaki
RYUKYU ISLANDS
Okinawa
KYUSHU
Hiroshima
HONSHU
MANILA
LUZON
PALAWAN
Kochi
SHIKOKU
Osaka
JAPAN
BORNEO
Sulu Sea
Celebes Sea
MINDANAO
PHILIPPINE ISLANDS
Pacific Ocean
CELEBES
TAIWAN
(Formosa)
IN ITS FAR EASTERN SETTING
Capitals
Provisional Capital
Capital of Taiwan
Provisional Capital of China
Other Cities
International Boundary
MI.
Approximate distances between Taiwan and neighbouring countries
Scale in miles
190 95 0 190 380
G.B.F. 51-05
Geographical Branch, Dept. of M. & T.S. 1951

FIG. 1

During the Franco-Chinese War of 1884-5 the French blockaded the island. They laid siege to Tansui and occupied Keelung for a few months. In 1885 Taiwan was separated administratively from Fukien and given provincial status. The Sino-Japanese War which broke out in 1894 ended the following year in the Treaty of Shimonoseki. By this Treaty China ceded Taiwan to the Japanese, but before the Japanese took over the Chinese on the island created an extremely short-lived republic. Because of the poor transportation and communication facilities of the island and also the active antagonism of the natives - Chinese as well as Malay - the Japanese could gain control of the island only after six years of hard fighting. Taiwan thus became Japan's first colonial possession and was subsequently developed by the Japanese.

However, the Japanese were never able to subjugate completely the Malay tribes of the mountainous regions despite numerous punitive expeditions. Towards the close of the Japanese period of control of Taiwan conciliation and education were beginning to succeed in the attempted pacification of the tribes where force had resulted only in failure. Taiwan in addition to being an area for colonial exploitation also became an advanced base for the Japanese attacks on South China, the Philippines and the South Pacific both before and during the Second World War.

In 1945, the Chinese Nationalist government received the surrender of the Japanese on Taiwan and occupied the island. Misunderstandings between administrators from the mainland and the Taiwan Chinese (Formosans) resulted in the revolt of March 1947. This revolt was, however, quickly suppressed. Later in 1949 when the Chinese Nationalist government abandoned the mainland to the Chinese Communist armies and set up a provisional capital in Taipei world attention focussed on the small island.

In the paragraphs which follow an attempt has been made to outline the salient characteristics of Taiwan's physical geography and to consider those aspects of its economic and social geography which can be explained as adaptations to environmental conditions. An understanding of Taiwan's geographical background is considered essential to an understanding of its present and future role in the Far East.

PART I

PHYSICAL GEOGRAPHY

The development or exploitation of any area by a people is dependent on two things, the physical environment and the stage of cultural development of the people. This chapter, dealing with the first of these conditions, outlines the structure and geology, landform and relief, climate, vegetation and soils of Taiwan.

STRUCTURE

Being an island of the circum-Pacific mountain chain Taiwan is similar in age to the Rocky Mountain area of British Columbia. The structure of the island, relatively simple for the major part, is formed by a tilted fault block running roughly northeast-southwest along its entire length. The steep slope of this tilted block faces east and the rock mass slopes less steeply to the west. This central block mountain is composed primarily of old depositional rocks, some of which have been subjected to change by heat and pressure.

Along the east coast there is a range of low mountains of volcanic origin. These are part of a secondary mountain arc which extends from Taiwan through the Ryukyu Islands to southern Japan. Between the coast range and the central mountains there is an extremely narrow defile.

In the northeast corner of the island lies a knot of low mountains of volcanic origin similar to those along the east coast.

These three mountainous areas constitute the structural core of the island. To the west the physical character of Taiwan changes through a foothill zone to an alluvial plain.

The island lies within one of the earth's earthquake belts and tectonic shocks are quite frequent. Over a 25-year period ending in 1933 the island and its neighbouring seas felt an average of 327 tremors a year.[1] Most of these earth movements were of a minor nature but through the years Taiwan has suffered a number of disasterous quakes. This activity is thought to be caused by a slow but general uplift of the Asiatic continental shelf - a movement which has probably been taking place almost imperceptably since late geological times.

GEOLOGY

The surface geology of the island varies in age from very recent alluvial deposits to early sedimentary and crystalline rocks. The generalized distribution of the surface geology is shown in Figure 2. Line AB on the map cuts across almost every rock type and geologic period to be found on the island. Starting from the east along line AB the geology is roughly as follows:

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[1] The Foreign Affairs Association of Japan. The Japan Yearbook, 1938-39. Tokyo. p. 971.

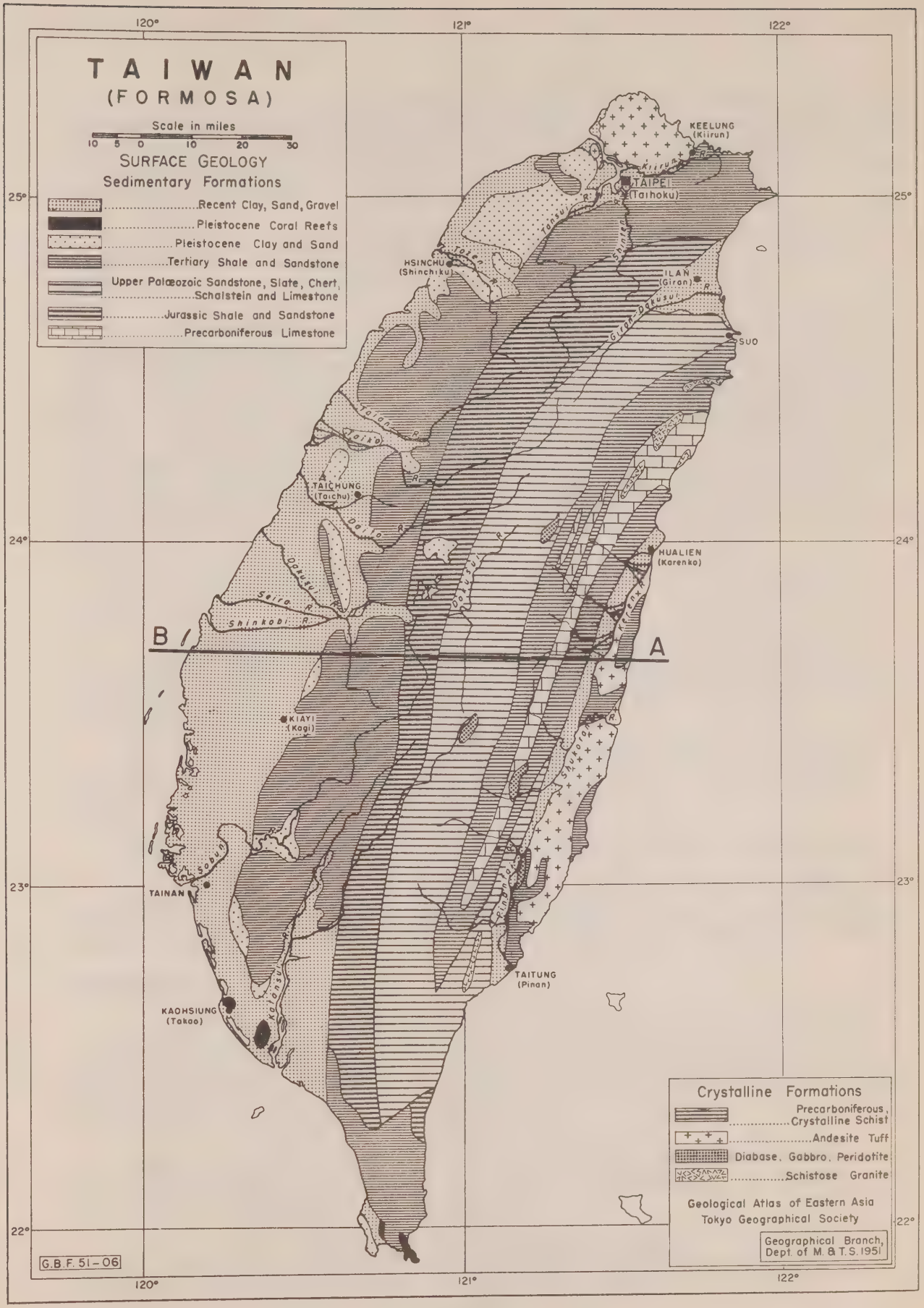
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
SURFACE GEOLOGY
Sedimentary Formations
Recent Clay, Sand, Gravel
Pleistocene Coral Reefs
Pleistocene Clay and Sand
Tertiary Shale and Sandstone
Upper Palæozoic Sandstone, Slate, Chert, Schalstein and Limestone
Jurassic Shale and Sandstone
Precarboniferous Limestone
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kiirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kogi)
TAINAN
KAOHSIUNG (Takao)
TAITUNG (Pinan)
A
B
Crystalline Formations
Precarboniferous, Crystalline Schist
Andesite Tuff
Diabase, Gabbro, Peridotite
Schistose Granite
Geological Atlas of Eastern Asia
Tokyo Geographical Society
Geographical Branch, Dept. of M. & T.S. 1951
G.B.F. 51-06

FIG. 2

1. The east coast mountains are composed of beds of shales and sandstones which have been slightly folded. Into these sedimentary rocks volcanic activity has introduced great masses of tuff. Like almost all the sedimentary and metamorphic rocks of the island shales and sandstones of the coastal mountains trend northeast-southwest.

2. The depression between the coastal mountains and the central mountain block of the island is covered by alluvial deposits - sands, clays and gravels washed down from the mountain slopes.

3. The central mountain block is formed by tilted beds of sedimentary and metamorphic rocks. The rocks vary in hardness from east to west, the hardest being the crystalline schists and the softest being the non-crystalline shales and sandstone. The easternmost formation is formed by tilted beds of crystalline schists older than most of the coal formations of the world. Within this formation, which is the result of heat and pressure on sedimentary rocks, there is a belt of limestone of the same age. West of the schists there is a wide belt of later sandstones, limestones, chert, schalsteins and slate. West of this formation one finds tilted beds of late shale and sandstone.

4. The westernmost slope of the central fault block is covered by glacial deposits of clay and sand.

5. Between these deposits and the west coast and running the length of the island there is a wide coastal plain of recent alluvial material - sand, clay and gravel. Similar alluvial material fills the basin of Ilan on the east coast.

6. In a number of places the principal rock formations have been intruded by acidic crystalline rocks of volcanic origin such as granite, gabbro, etc.

The mountains of the extreme northwest are formed by volcanic ash.

In the south of the island there are a number of uplifted coral reefs which were built up along the island's shores during the Pleistocene period. However, the area covered by these calcareous reefs is not great.

PHYSIOGRAPHY

Generally speaking the island can be divided into two parts - a rugged mountainous eastern section which occupies roughly two thirds of the island's area and a low flat coastal plain which occupies the western third. Approximately 21.0% of the island is over 3,000 feet high and about 57.6% lies below 1,500 feet.[1] (Figure 3)

The eastern portion of the island can be divided into at least six physiographic divisions. These divisions are illustrated in Figure 4. They can be briefly described as follows.

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[1] Chow, C.Y. The Anopheline Mosquitoes of Taiwan. Quarterly Journal of the Taiwan Museum, Vol. II, No. 1. March, 1949. p. 3.

1. The Coastal Mountains: These mountains are part of the mountain arc which extends from Taiwan through the Ryukyu Islands to southern Japan. They form part of the eastern coast of Taiwan extending from just north of Taitung to just south of Hualien. The mountains are partly folded and partly of volcanic origin. They rise steeply from the water to elevations of over 7,000 feet in the south, but are less than 3,000 feet high in the north. The Shukoran River divides the high southern mountains from the lower ones to the north. The base of the chain is extremely narrow being only 10 to 15 miles wide. As a result the mountains are extremely rugged. The coastline has few indentations and few harbours but deep offshore water. Generally speaking the shoreline is marked by steep, extended shore-cliffs. The face of the cliffs is broken only by the mouths of the short, swift-flowing rivers; rivers which become raging torrents after each heavy rain. Each of the rivers which flows out of the mountains is building up an alluvial fan of coarse sediments.

2. The Taitung-Hualien Trench: This trench is of tectonic origin and lies between the Coastal Mountains and the Central Mountains. The west side of the valley is formed by the steep face of the faulted Central Mountain block.

Since the valley averages only from 5 to 9 miles in width throughout its length it appears like a deep cut slashed into the mountainous surface of the island.

The floor of the trench is covered by thick deposits of alluvial material brought down from the mountains. Much of the western part of this alluvial plain is formed by coalescing alluvial fans. Many of the streams which debouch onto the plain from the Central Mountains have a large number of distributaries or mouths.

The trench trends roughly northeast-southwest and meets the sea at either end. The trend of the topography is further emphasized by the streams which flow along the valley floor. The Pinantai flows southward, emptying into the sea at Taitung. The Shukoran flows northward in a braided channel and empties into the sea through a break in the coastal range. The Keren River flows northwards emptying into the sea at the northern end of the trench.

3. The Central Mountains: These mountains form the backbone of the island. The tilted fault block has been eroded into a large number of peaks of which more than 30 attain heights of over 10,000 feet. In elevation they are comparable to the Canadian Rockies. The heavy rainfall has deeply scored the mountain sides with river valleys and canyons. The relief is great and the forest-clad mountains with their extreme ruggedness are almost impenetrable.

The Central Mountains form the coastline to the north and south of the Taitung-Hualien Trench. This part of the coastline is straight and precipitous. To the south the mountains extend from the plain about Taitung to the Southern Foothills. Here the ends of five ranges extending eastward from the central north-south axis of mountains meet the sea and form the coastline. North of the Trench the mountains extend to the Ilan


TAIWAN
(FORMOSA)
Scale in Miles
10 5 0 10 20 30
RELIEF
Below 1000'
From 1000' to 3000'
From 3000' to 5000'
From 5000' to 7000'
From 7000' to 9000'
From 9000' to 12000'
Over 12000'
120°
121°
122°
25°
24°
23°
22°
G.B.F. 51-07
Geographical Branch,
Dept. of M. & T.S. 1951

FIG. 3

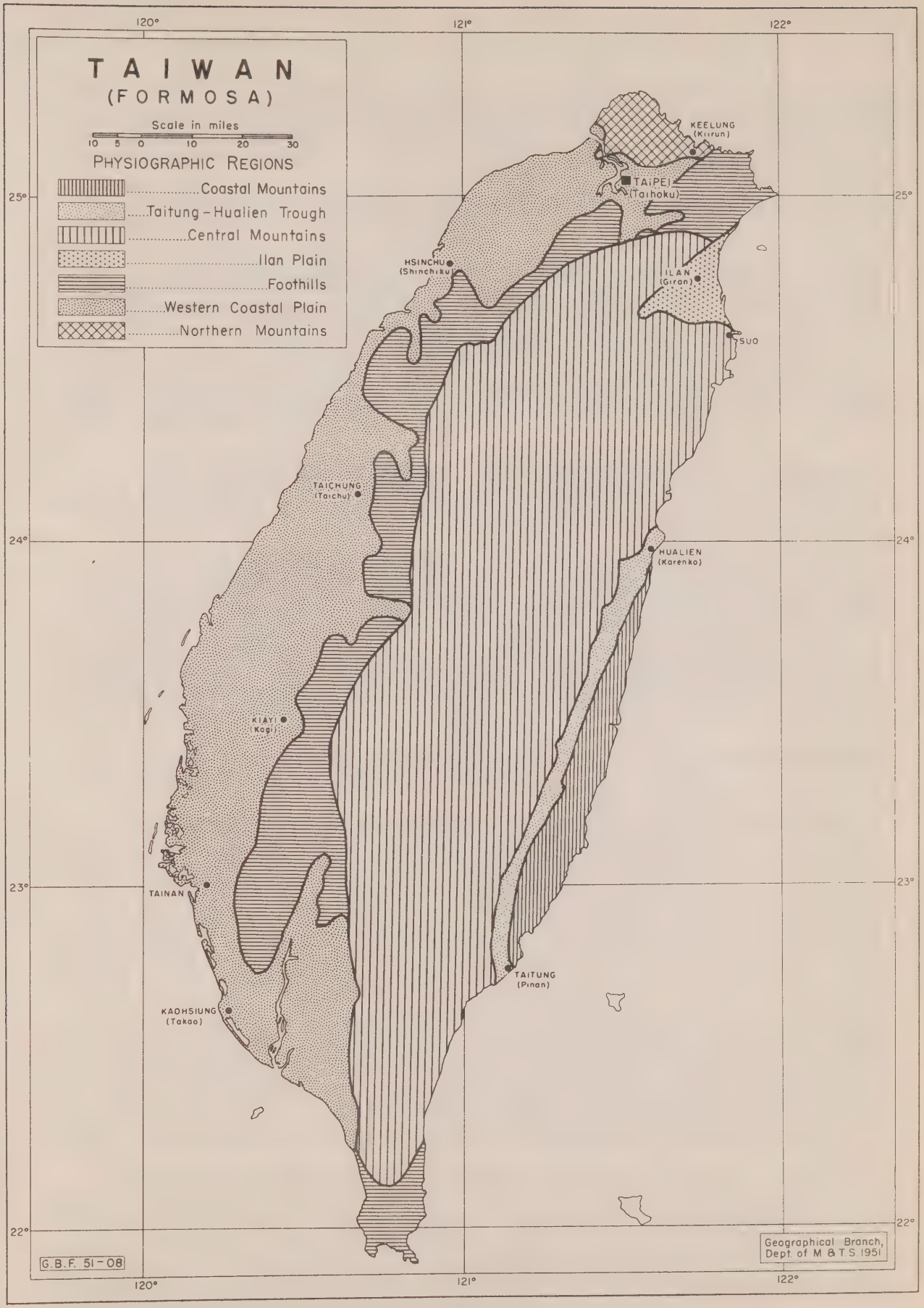
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
PHYSIOGRAPHIC REGIONS
Coastal Mountains
Taitung – Hualien Trough
Central Mountains
Ilan Plain
Foothills
Western Coastal Plain
Northern Mountains
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
G.B.F. 51-08
Geographical Branch,
Dept. of M & T.S. 1951

FIG. 4

Plain. Here also shore cliffs rise precipitously out of the sea in places to elevations of 6,000 to 10,000 feet. The east coast is therefore on the whole steep-to with very deep water immediately offshore. Harbours are practically non-existent along the mountainous sections of the coast.

Mt. Morrison (23° 29' N., 120° 58' E.) at an elevation of 13,145 feet is the highest point in the island.

4. The Ilan Plain: This is a triangular alluvial plain in the northeastern part of the island. The base of the triangle is formed by the coast and its apex penetrates the Central Mountains. The Ilan River with its source high in the Central Mountains bisects the plain from its apex to the sea. The plain has been built up by alluvial materials brought down by the river. There is only one good harbour along the Ilan coast and this is at the southern tip of the plain, at Suo, where the plain and the mountains meet.

5a. The Western Foothills: The Western Foothills lie along the gentle westward slope of the island's tilted central block. This landform is the result of stream erosion on the soft shales and sandstones.

5b. The Southern Foothills: This is an area of low mountains rising to elevations of up to 3,000 feet interspersed with rolling alluvial plains. These low mountains like the Western Foothills are cut from soft shales and sandstones. This physiographic region occupies most of the Koshun Peninsula. The east coast is bordered by the hills and rises steeply from the water. The western coast of the region is formed by a low flat coastal plain. While the east coast is steep-to, the west coast waters are extremely shallow.

The western part of the island can be divided into two subregions on the basis of physiography.

6. The Western Coastal Plain: This region, wherein dwell most of the people of Taiwan, is a low flat alluvial plain covering almost one-third of the island and extending from Keelung in the north to the Koshun Peninsula in the south. Generally speaking the plain is formed by recent alluvium. There are, however, large areas of glacial clay and sand on this plain. They stand up above the general level of the plain in the form of low plateaux. There is little relief along the coast but the plain rises gently to the level of the foothills.

Where rivers flow out of the Western Foothills onto the plain they form large alluvial fans. Each large river as it flows out of the foothills divides into a number of channels - an indication of the marked change in slope. The Dakusui River is a good example of this phenomenon. Because of gentle slopes on the plain, rivers meander sluggishly across it to the sea. Many of these have been linked by irrigation and drainage canals.

The western edge of the plain where it meets the sea is marked by wide tidal flats. The coastline generally speaking is quite swampy. In the south, from the Koshun Peninsula to the Daito River, shore currents have built up a series of offshore sand-bars. Many shallow, brackish lagoons have been formed where these sand-bars have shut off the river mouths from the sea. Although the offshore waters are quite shallow there are a number of good ports along this coast.

7. The Northern Mountains: This physiographic region consists of a group of volcanic peaks in the extreme northwest of the island rising to elevations of 3,700 feet. The boundary of this region where it meets the alluvial coastal plain is marked by the Tansui and Keelung (Kiirun) rivers.

The rivers of the island are generally speaking quite short and rapid. (Figure 5) Where they flow across any extended area of level ground they meander sluggishly. Because of their short courses and steep grades many of the rivers contain little water except after heavy rains when they become raging torrents. The flood crest on some of the streams emptying into the Pacific Ocean has been reported by the U.K. Admiralty China Sea Pilot as being as much as 30 feet after a heavy rain.

Although the island is a centre of tectonic activity none of the volcanic peaks of the Northern Mountains or the Coastal Mountains are active at present.

CLIMATE

The Climatic Factors

Four factors dominate the climatic regimes of Taiwan - latitude, ocean currents, relief and the island's position relative to the continent. Of these factors the last is considered to be the most important.

The island lies athwart the Tropic of Cancer. Thus because of its latitude it enjoys a semi-tropical temperature regime. The Kuro Siwo ocean current flowing northward is split by the Koshun Peninsula and thus ameliorates the climate of both the east and west coasts of the island. In winter the major part of this ocean current flows along the east coast. The result of this factor and the general maritime aspect of Taiwan is a relatively low seasonal range in temperature. There is never any frost in the lowlands in winter and summer temperatures rarely reach 100° F.

Relief, however, plays a significant role in the temperature regime for there is a significant decrease in temperature with altitude. The position of Taiwan relative to continental Asia determines the island's rainfall regime. During the winter the northeast monsoon system of Central Asia strikes the northeastern corner of the island. These strong winds blowing off the sea provide this part of the island with continuous cloudy weather and rain. (Figure 6) The high mountains effectively prevent these rainy winds from penetrating inland to any great distance. During the summer the island lies within the system of the southwest monsoon. These winds are generally light and variable but bring the southern part of the island considerable rainfall. Summer is also the typhoon season; the typhoons, sweeping north from the storm centres in the South China Sea, bring heavy rain and often considerable damage in the southern portions of the island.

Precipitation

The distribution of precipitation is controlled by relief and season. There is a great deal of orographic rainfall with heaviest falls occurring


TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
HYDROGRAPHY
SHOWING MAJOR RIVER SYSTEMS
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kiirun)
Kiirun R.
TAIPEI
(Taihoku)
Tansui R.
Shinten R.
HSINCHU
(Shinchiku)
Tozen R.
ILAN
(Giran)
Giran-Dakusui R.
SUO
Taian R.
Taiko R.
TAICHUNG
(Taichu)
Daito R.
Dakusui R.
HUALIEN
(Karenko)
Seira R.
Shinkobi R.
Keren R.
KIAYI
(Kagi)
Hassho R.
Kyusui R.
Nanshisen R.
Reno R.
Shukoran R.
Sobun R.
TAINAN
Paoshiko R.
Pinanlai R.
TAITUNG
(Pinan)
Kaoansui R.
KAOHSIUNG
(Takao)
Rinhen R.
G.B.F. 51-09
Geographical Branch,
Dept. of M. & T.S. 1951

FIG. 5

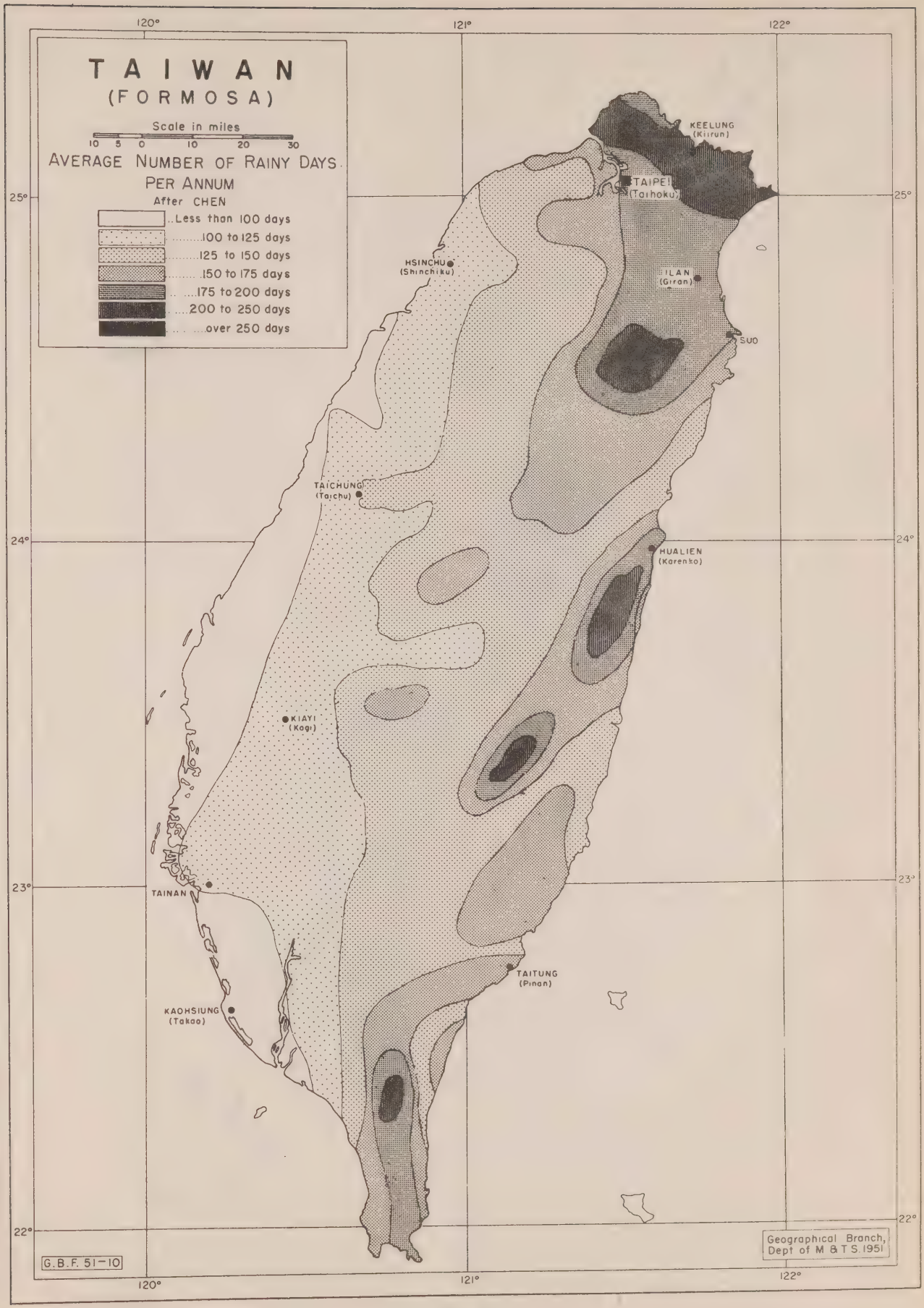
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
AVERAGE NUMBER OF RAINY DAYS PER ANNUM
After CHEN
Less than 100 days
100 to 125 days
125 to 150 days
150 to 175 days
175 to 200 days
200 to 250 days
over 250 days
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kiirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kagi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
G.B.F. 51-10
Geographical Branch, Dept of M.&T.S. 1951

FIG. 6

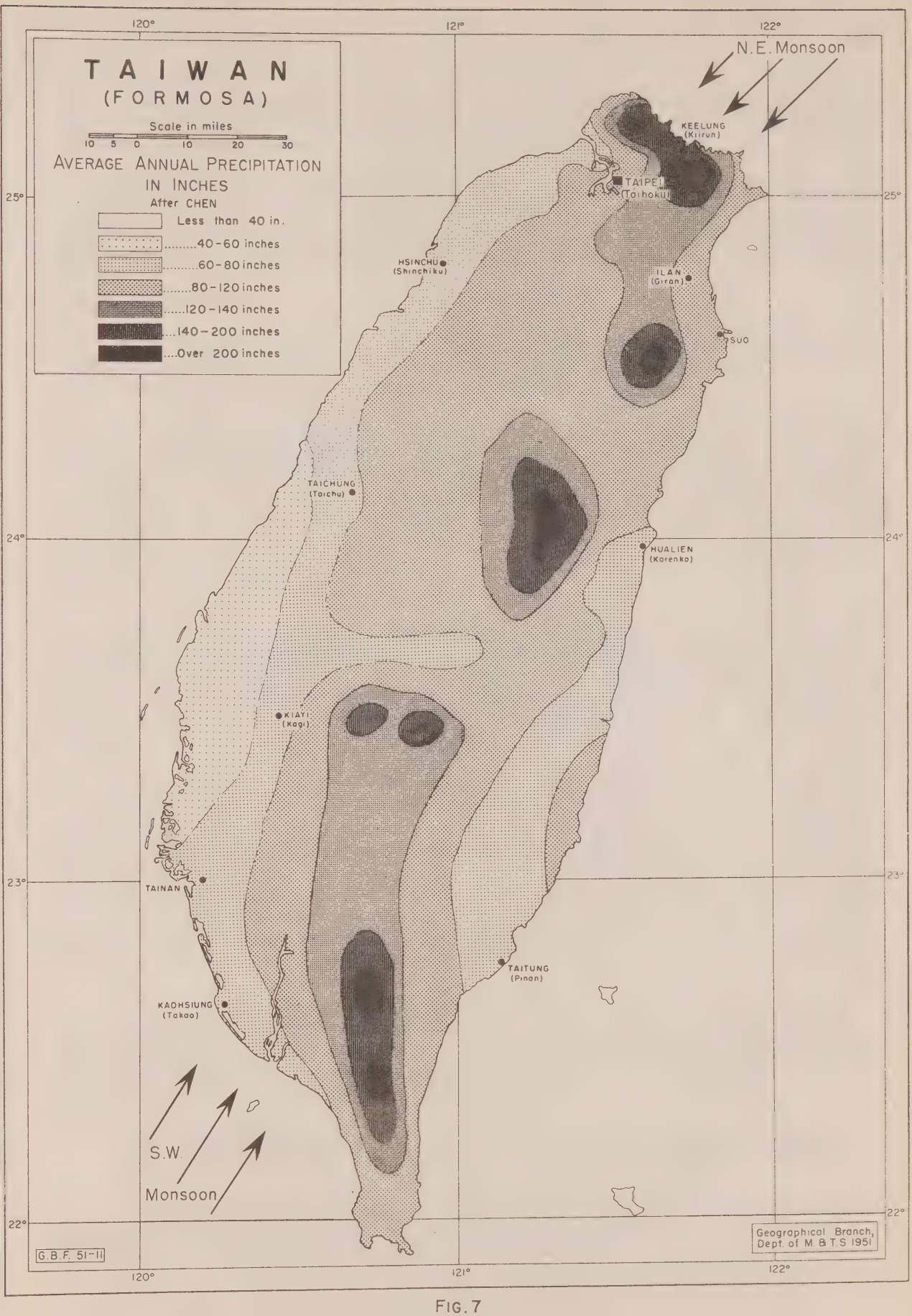
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
AVERAGE ANNUAL PRECIPITATION IN INCHES
After CHEN
Less than 40 in.
40-60 inches
60-80 inches
80-120 inches
120-140 inches
140-200 inches
Over 200 inches
N.E. Monsoon
S.W. Monsoon
KEELUNG (Kirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kagi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
120°
121°
122°
25°
24°
23°
22°
G.B.F. 51-11
Geographical Branch, Dept. of M. & T.S. 1951

FIG. 7

on the mountain slopes. (Figure 7) The western coastal plain lies within the rain shadow of the Central Mountains and as a result the central part of the west coast is the driest place on the island.

The northeast corner of the island has a winter rainfall maximum whereas the rest of the island gets most of its rain in the summer (April to September inclusive). While the northeast has no distinct dry season the southwestern parts of the island have a marked winter dry season.(Figure 8)

Climatic Regions

It is possible to divide the island into a number of climatic regions based on considerations of temperature, precipitation and relief. C.S. Chen[1] has delineated the following six regions. (Figure 9)

1. Northeast Corner: The dominant climatic feature in this region is the northeast monsoon. Although the region has rainfall the year round the precipitation maximum comes in winter. Ilan with an average annual precipitation of 100 inches receives 40% of its rain from September to November inclusive. The prevailing northeast winds blow off the sea almost the entire year. This results in an extremely large number of cloudy days. Keelung (average annual precipitation of 114 inches) has an average of 213 rainy days each year.

2. Northern Region: This region is a transition zone between the northeastern and the southwestern parts of the island. While there is no distinct dry season in this region the rainfall maximum occurs during the summer. The coolest winters on the lowlands occur here. The mean temperature for February, the coldest month, is just below 60° F. (58.3° F. at Hsinchu) an indication of the island's semi-tropical temperature regime.

3. Western Plain: The western plain region is cut off from the northeast monsoons by the Central Mountains and as a result has a distinct dry season. This is quite important to the agriculture of the region. The southwest monsoons bring heavy summer rains. The rainy season starts at the end of April, and in each month from May to August inclusive an average of over eight inches of rain falls. The rainfall variability is great and dry spells are frequent especially during the winter. (Figure 8) Winters in addition to being relatively dry are quite warm, with the temperature of the coldest month averaging from 60 to 68° F.

4. Southern Region: This region has a tropical climate with no month having an average temperature below 68° F. Between 80 and 90% of the precipitation falls in summer. The total average annual rainfall on the lowland varies from 60 to 100 inches. The winter dry season is emphasized by dessicating gales.

5. East Coast Region: This narrow climatic region encompasses the Coastal Mountains and the Taitung-Hualien Trench. The differences in

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[1] Chen, C.S. Agro-Climate of Formosa. Memoirs of the Faculty of Agriculture, National Taiwan University. Vol. II, No. 1, January, 1948 - 60 pages.

temperature, and more particularly in rainfall within this region, are the result of exposure (i.e., whether or not slopes face the prevailing wind) and relief.

The average annual rainfall varies from 60 to 80 inches, two-thirds of which falls during the summer. Floods are quite common in the rainy season. The winters are quite warm, the coldest month averaging over 60° F., but are not as dry as those of the southern and western plain regions.

6. Central Mountains Region: As in the East Coast Region relief and exposure to prevailing winds cause a great diversity in climate. The average annual precipitation is well over 118 inches. The higher mountains are snow covered during the winter.

The climatic regions of Taiwan correspond closely to the agricultural regions. The influence of climatic factors, as well as other physical factors of the environment, on the island's agriculture will be discussed in the section on Taiwan's economic geography.

NATURAL VEGETATION

Except for the upper slopes of the mountains Taiwan was once covered entirely by thick forests. Settlers through the years have cleared the forest from practically all the lowland areas suitable for agriculture with the result that today approximately 68% of the island's area, an estimated acreage of 6,158,975[1], is still forested. Approximately 80% of this forested acreage is covered with trees while the remaining 20% is covered by shrubs.

The flora of Taiwan is closely related to that of Southeast Asia and South China (i.e., the Indo-Malayan Flora), the link being supplied by the Kuro Siwo. Three plant formations are dominant on the island - broad-leaved evergreen forests, mixed forests of broad-leaved deciduous trees and conifers, and coniferous forests. About two-thirds of the island's trees are members of the first formation while the coniferous forest, which is the most important economically, represents only an estimated 16% of Taiwan's trees. Two minor types of vegetation are distinguishable, the relatively small bamboo forests along the Western Foothills and the somewhat more extensive steppe and scrub growth found almost everywhere on the lower slopes of the mountains. (Figure 10)

1. Coniferous Forests: This vegetation region is to be found above 10,000 feet. On the lower slopes of this zone there are large forests of small to medium sized conifers and an undergrowth of deciduous shrubs. Pure stands of the dominant species, abies Kawkamii, are widespread. The higher slopes are covered by grasslands on which are to be found junipers (Juniperies squamata) and numerous deciduous shrubs.

2. Mixed Forests: This vegetation zone is to be found on the mountain slopes at elevations of from 6,500 to 10,000 feet. It includes mixed

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[1] Munn, G.W. Forestry and Forest Resources of Formosa (Taiwan). Australian Forestry, Vol. 12, No. 2. 1948. p. 112.

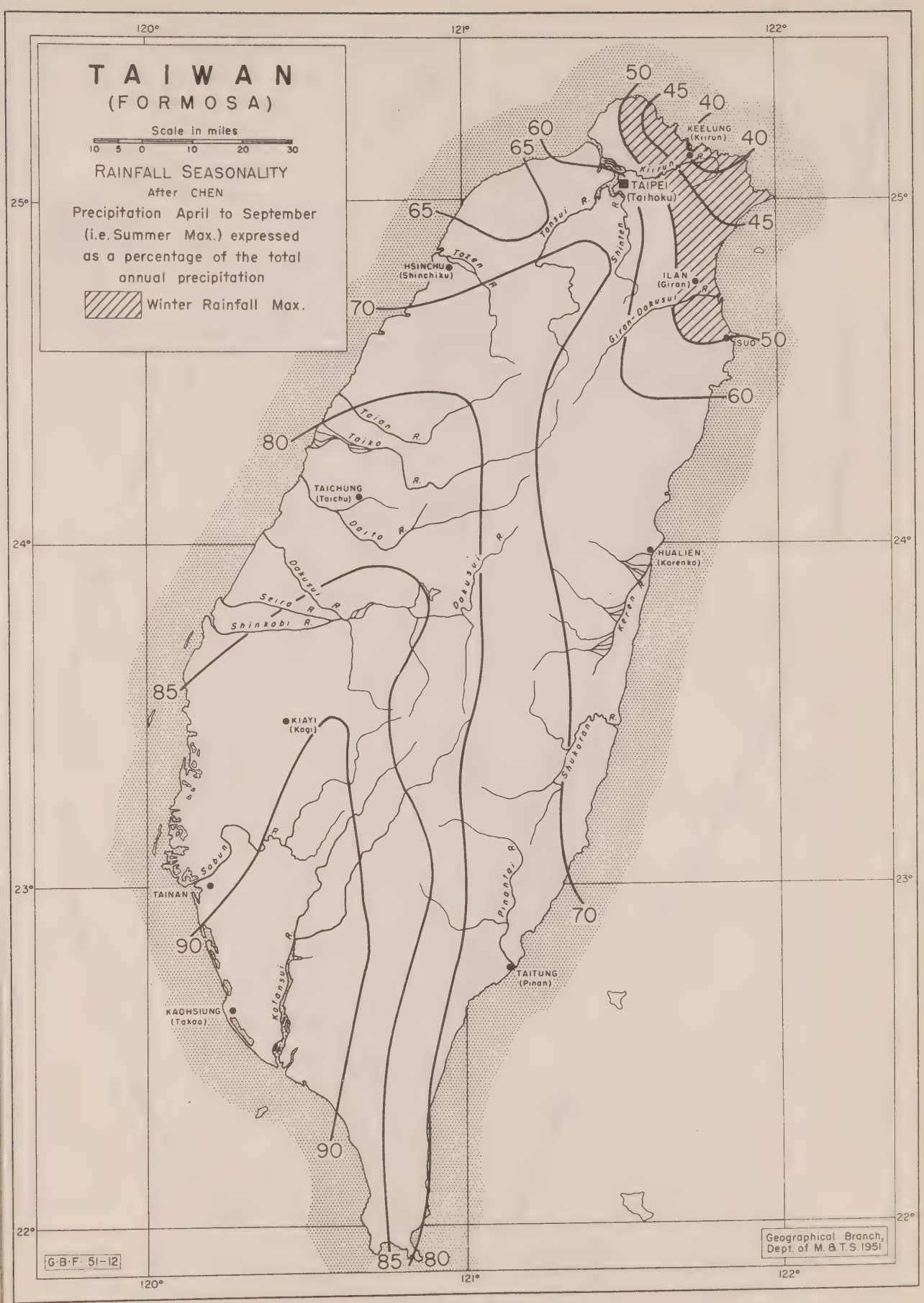
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
RAINFALL SEASONALITY
After CHEN
Precipitation April to September (i.e. Summer Max.) expressed as a percentage of the total annual precipitation
Winter Rainfall Max.
120°
121°
122°
25°
24°
23°
22°
50
45
40
40
60
65
65
45
70
50
60
80
85
90
90
85
80
70
KEELUNG (Kiirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Korenko)
KIAYI (Kagi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
Kiirun R.
Tansui R.
Shinten R.
Toyen R.
Giran-Daikusui R.
Taian R.
Taiko R.
Daito R.
Daikusui R.
Seira R.
Shinkobi R.
Kotan R.
Shukoran R.
Sabun R.
Pinanlai R.
Kaoansui R.
G·B·F· 51-12
Geographical Branch, Dept. of M. & T.S. 1951

FIG. 8

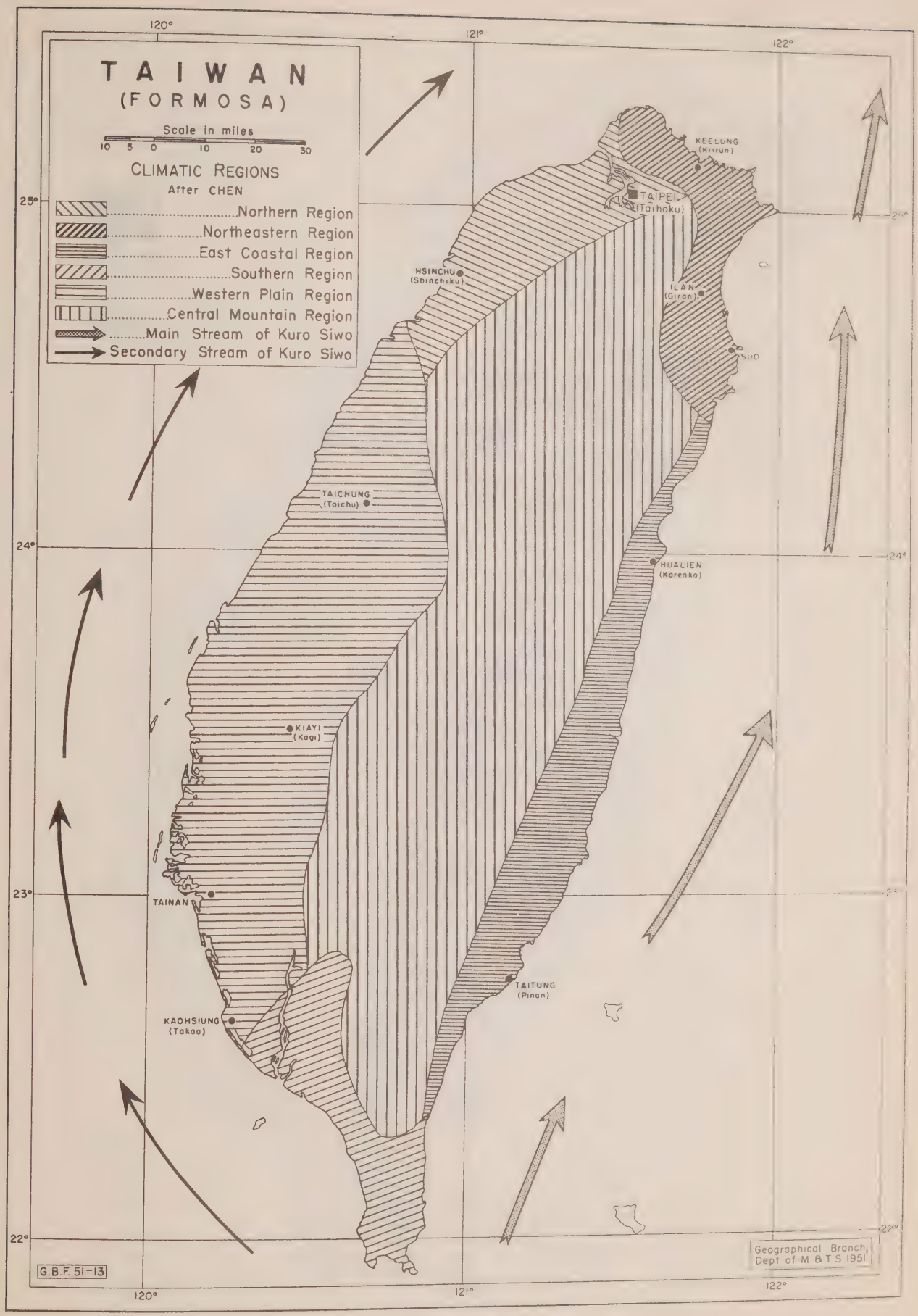
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
CLIMATIC REGIONS
After CHEN
Northern Region
Northeastern Region
East Coastal Region
Southern Region
Western Plain Region
Central Mountain Region
Main Stream of Kuro Siwo
Secondary Stream of Kuro Siwo
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirrun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
G.B.F. 51-13
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FIG. 9


TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
FORESTED AREAS
After CHEN
.....Coniferous Forests
.....Mixed Forests
Broad-Leaved Trees
...Steppe and Shrubs
.....Bamboo Forests
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirun)
Kirun R
TAIPEI
(Taihoku)
Tamsui R
HSINCHU
(Shinchiku)
Tosen R
ILAN
(Giran)
Suo
Toroan
Taiko
TAICHUNG
(Taichu)
Daito R
HUALIEN
(Karenko)
Dokusui R
Seira R
Shinkobi R
KIAYI
(Kagi)
Shuikuo R
Sobun R
TAINAN
TAITUNG
(Pinan)
Kaoansui R
KAOHSIUNG
(Takao)
G.B.F. 51-14
Geographical Branch,
Dept of M.B.T.S. '95

FIG. 10

forests of deciduous and coniferous forests. The undergrowth in these forests consist of small trees and shrubs. The dominant tree types include cedars (Chamoecyparis obtusa and Chamoecyparis formosensis, the largest tree on the island), Ilex spp., maples (Acer Kawkamii), Rhododendron spp., junipers (Juniperus formosana) and Taiwania cryptomerioides, a tall straight conifer. The coniferous forests are to be found on the upper slopes of the zone, the dominant varieties being hemlock (Tsuga formosensis) and pine (Pinus Armandi).

3. Broad-leaved Forests: This vegetation region lies between 1,500 and 6,500 feet above sea level. It is the region of broad-leaved evergreen forests with dense undergrowth. Within these forests there is considerable zonation with elevation with three broad subregions being distinguished. On the lowest slopes of the region the following species are dominant - Bischoffia javonica, Cleyera ochnaceo, Lagerstroemia, subcostata, evergreen oaks, palms (Calamus Margaritae) and tree ferns (Cyathea and Alsophila).

On the middle slopes of this region are found some of the largest trees of the island - camphor trees (Cinnamonum Camphora), Engelhardia formosana and Machilus Kusanoi (two very large conifers), and Tetradenia Konishii.

On the upper slopes deciduous varieties such as oak, maple and chestnut are to be found along with the broad-leaved evergreen trees and shrubs.

The second growth forests of this subtropical zone often contain pure stands of deciduous oak (Tuercus variabilis). Large alders (Alnus formosana) are also to be found.

4. Bamboo Forests: Bamboo forests are prominent throughout the plains forests zone. In the south there are a number of large tracts covered with pure stands of palm trees, in particular the Phoenix Hancena, a variety of date palm. The mango tree (Magnifera indica) is found throughout the settled part of the island in the villages and along all the roads.

5. Steppe and Shrubs: This type of vegetation occurs in the foothills along the line of transition between mountain and plain. Here it does not reflect either a soil or climate adverse to tree-growth. Rather it represents secondary and subsequent growth in those broad-leaved and mixed forests areas where cutting and burning of forests has resulted from the pressure of population on the land. This occurs principally between the 1,000 and 3,000-foot contours.

A second area of steppe vegetation appears towards the crest of the Central Mountains in the form of Alpine meadows - a vegetation which directly reflects the variation of average annual temperature inversely with altitude.

SOILS

"Soil is a natural body of mineral and organic constituents, differentiated into horizons (i.e., layers) of variable depth, which differ from the material below in morphology, physical make-up, chemical properties and

composition, and biological characteristics".[1] Generally speaking soils are produced by the interaction of climatic factors, vegetation and weathered materials. Variations of these factors have caused a diversity in the soils produced in different parts of the world, the chief criterion for distinguishing such differences in soils being the character of the soil horizon. As there are climatic and vegetation zones, so are there soils zones. These three types of zones are usually quite closely related.

The soils of Taiwan are diverse, the chief reasons being the great changes in relief with resultant variation in climate and vegetation.

1. Podsols and Slightly Podsolized Alpine Soils: Podsols, associated generally with coniferous forest cover, are found on the mountain slopes above the gray-brown podsolic soils. They are less fertile and are easily identified by the light gray horizon, from which the soluble salts have been leached, directly under the black surface layer.

Alpine soils show podsol tendencies and are found on mountain slopes and meadows above 8,500 feet. The profile or accumulation of horizons is quite shallow. These soils normally develop under the forests and grasslands of the colder areas of the world and directly reflect altitudinal decrease of temperature.

Except for the alluvial and the saline soils the soils of Taiwan are developed on diluvial material - that is, they are developed directly on the weathered bedrock. In the forest areas, with their dense undergrowth, soils are protected from excessive erosion. Erodability of the soils is greatest on the east-facing slopes of the eastern half of the island where rainfall is the heaviest.

2. Grey-brown Podsolic and Yellow Podsolic Soils: The soil zone is to be found on the mountain slopes between 6,500 and 8,500 feet and the representative soils have developed primarily under a vegetation of mixed forest. These soils are more fertile than the soils of the lower slopes since they have a higher nitrogen content. However, slope and poor accessibility preclude any extensive agricultural use of the podsolic soils.

3. Yellow and Red Soils: The red earths are the deep red, fully weathered soils of the lower slopes. They are decidedly acid in nature and lack sufficient humus to make them fertile. Associated with them are the yellow earths. They too are found on the lower levels of the island and like the red earths are developed under broad-leaved evergreen forests. The yellow earths are acidic in nature but are not as fully weathered as the red earths. Both are lateritic soils, and are rich in iron and alumina.

4. Saline Soils: Of the many different types of saline soils to be found in the world Taiwan has those which have developed on tidal flats. These soils are found only on the diked tidal lands along the west coast of the island and are very prominent in the southwestern portion of the island.

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[1] Joffe, J.S. Pedology, 2nd edition. New Brunswick, N.J. 1949. p. 41.

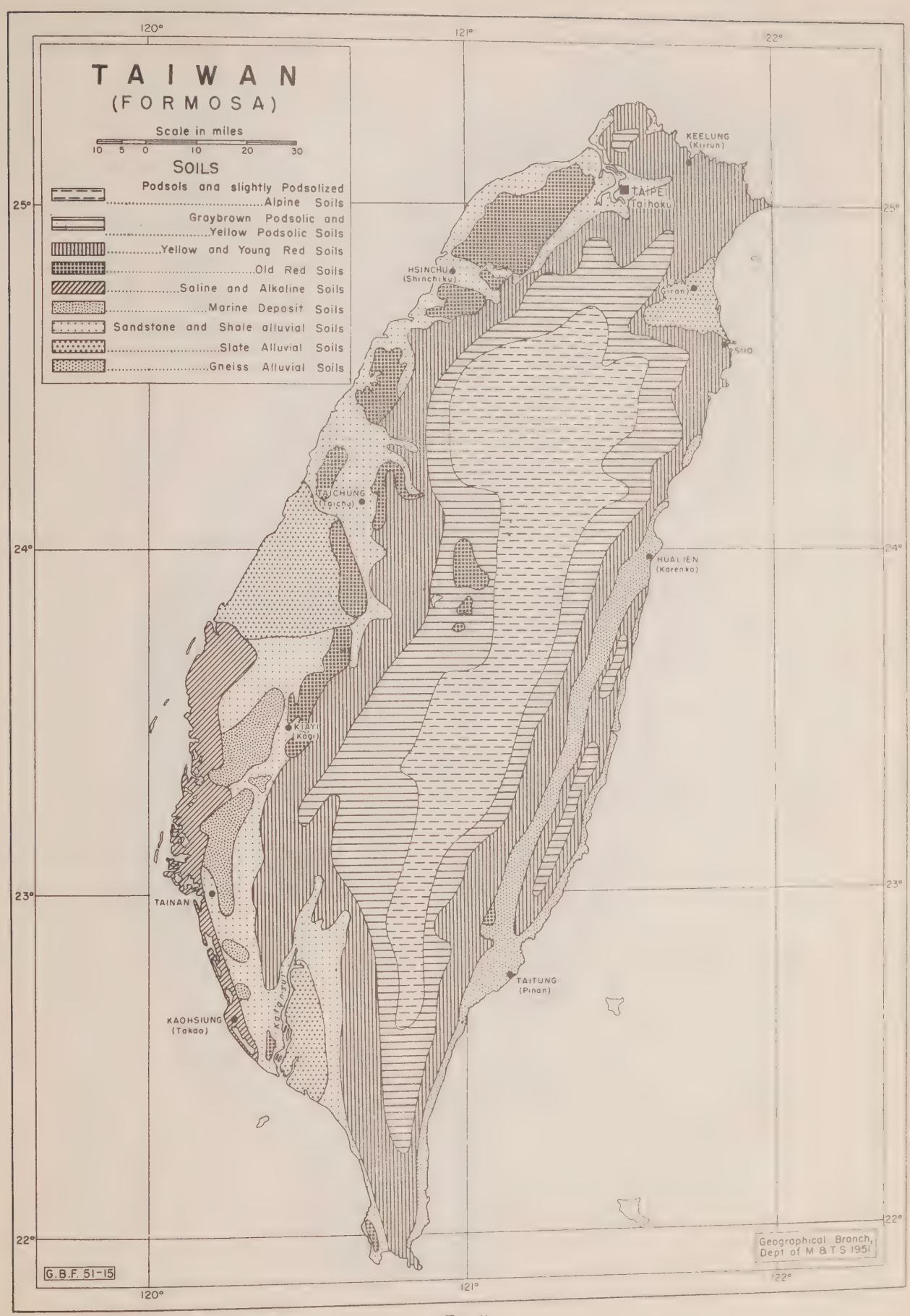
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
SOILS
Podsols and slightly Podsolized
Alpine Soils
Graybrown Podsolic and
Yellow Podsolic Soils
Yellow and Young Red Soils
Old Red Soils
Saline and Alkaline Soils
Marine Deposit Soils
Sandstone and Shale alluvial Soils
Slate Alluvial Soils
Gneiss Alluvial Soils
120°
121°
22°
25°
24°
23°
22°
KEELUNG
(Kiirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
Kaoping R.
Geographical Branch,
Dept of M & T S 1951
G.B.F. 51-15

FIG. II

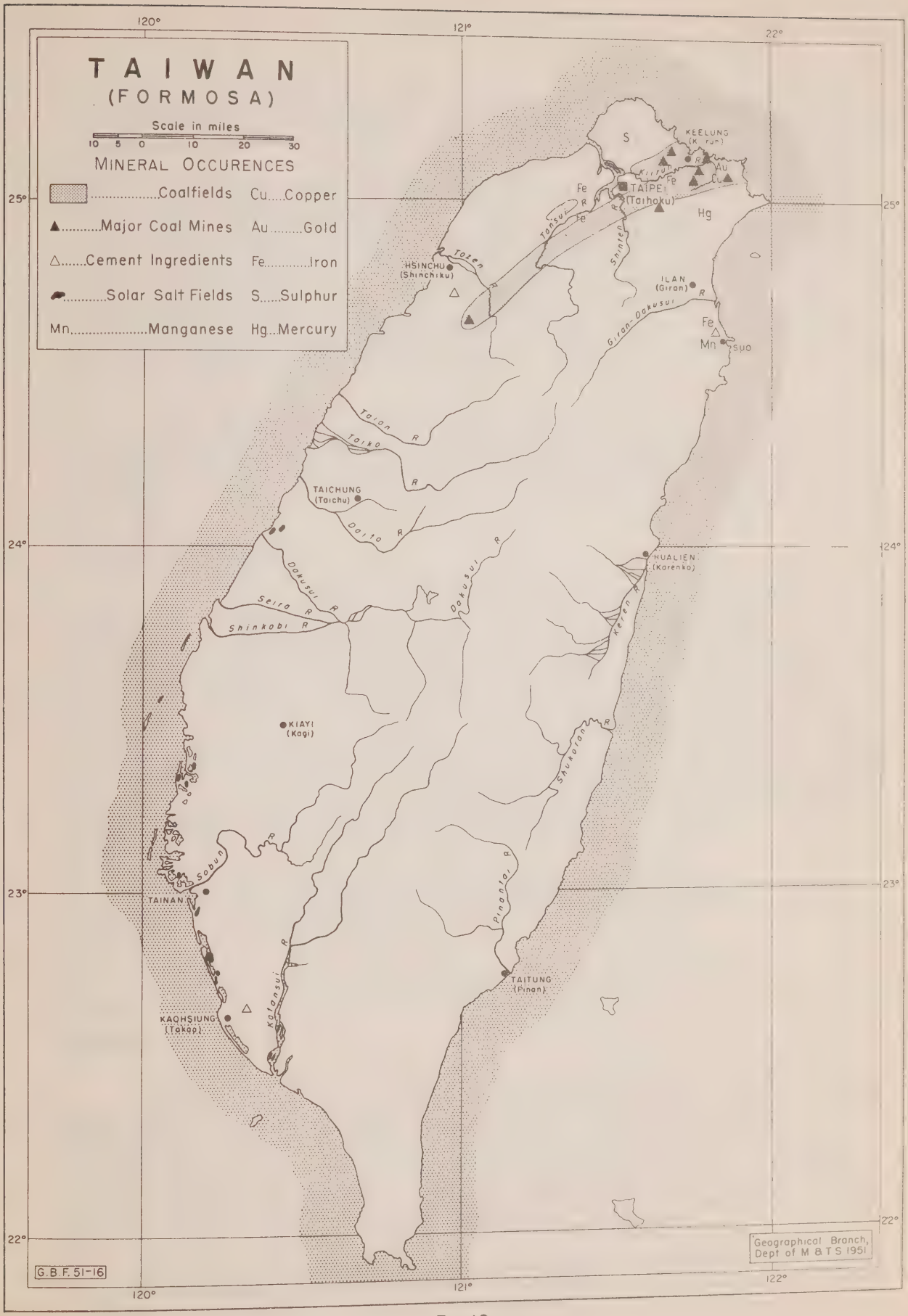
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
MINERAL OCCURENCES
Coalfields
Major Coal Mines
Cement Ingredients
Solar Salt Fields
Mn Manganese
Cu Copper
Au Gold
Fe Iron
S Sulphur
Hg Mercury
120°
121°
122°
22°
23°
24°
25°
KEELUNG
(Karun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
HUALIEN
(Karenko)
TAICHUNG
(Taichu)
KIAYI
(Kagi)
TAINAN
KAOHSIUNG
(Takao)
TAITUNG
(Pinan)
Tozen
Tansui R
Shinten
Giran-Dakusui
Toran R
Taiko R
Daito R
Dakusui R
Seito R
Shinkobi R
Karen R
Shukorian R
Pinanlai R
Kaoansui R
Sobun R
Geographical Branch,
Dept of M & TS 1951
G.B.F. 51-16

FIG. 12

5. Alluvial Soils: These are formed by the deposition of rivers. The distribution of the various types of alluvial material is shown in Figure 11. Grayish in colour and high in mineral content they are the major soil of the central and southern parts of the western coastal plain. These soils are generally fertile but low in humus content. They are neutral to slightly alkaline, being among the least acid of Taiwan's soils. Because these alluvial soils are formed by the coalescing of many alluvial fans there are large areas of coarse infertile sands and cobblestone washes. Physiographically they may be divided into two major categories, residual and alluvial. As is to be expected the residual soils, those which have developed in situ, are found in the plain, foothill and upland areas of the island, whereas the alluvial soils are of more recent origin and predominate in the low-lying coastal areas.

When regarded physiologically both these soil groups fall within the pedalfer class, i.e., a soil characterized by the presence of aluminum and iron. Although Figure 11 shows the detailed distribution of the soils of Formosa they can be discussed under general types arranged by vertical zonation.

MINERAL OCCURRENCES

Taiwan is not particularly well-endowed with mineral resources, but, since much of the mountainous area of the island has not been explored geologically in any detail, the situation with respect to the mineral resources may be changed drastically in the future. The most important rock formations in terms of minerals are the Tertiary shale and sandstone beds of the island. These rocks are petroliferous, containing pools of petroleum and reserves of natural gas. Figure 12 shows the approximate distribution on the island of probable and possible oil reserves. Bituminous coal is found interbedded with shales and sandstone in the northern part of the island. Large reserves of copper ore and some gold veins are located in the extreme northeastern part of this formation. Sulphur is found in economic quantities throughout the areas of volcanic rocks.

Mercury and manganese ores are found in the mountains about the Ilan Basin - the mercury ores in the Jurassic rocks and the manganese ores in the Palaeozoic rocks.

Traces of copper ore and mica have been found in the crystalline schist formations, but not in economic quantities.

SUMMARY

From this brief survey of the physical geography of Taiwan it can be seen that its position relative to the coast of China, within monsoonal Asia and straddling the Kuro Siwo accounts for its sub-tropical nature. Tectonic forces have so changed the character of the island to give it a high central mountain core, somewhat displaced to the east. A rugged coastal mountain on the east is equally uninviting to settlement. Dense tropical forests dominate the upland areas and only in the lowlands of the west is Taiwan conducive to agriculture and settlement.

In the paragraphs which follow an attempt is made to show how the economic and social organization and development of the island is related to several factors of its physical endowment.

PART II

ECONOMIC AND SOCIAL GEOGRAPHY

Within the limits imposed by the factors of the physical environment a number of possibilities exist for economic development in each region. The possibility which is pursued is dependent on the cultural level of the people occupying the region. Changes in culture - in techniques, or in social organization, for example - will often result in a change in the economic development. Either the old channel of development will be extended or what is more often the case, a new untouched possibility will be explored.

ECONOMIC DEVELOPMENT

As in most regions the economic development of the island has undergone considerable change, as its resources have come under the control of different culture groups. These changes of control - that is, changes in economic demand - which have directed the economic history of Taiwan, have produced three major periods of development - the Pre-Japanese period, the Japanese period and the recent Chinese period.

The Pre-Japanese Period. When the Japanese were ceded Taiwan in 1895 the island was in a primitive economic state by western standards. Yet its status was typical of monsoon Asia, for the basic patterns seen on Taiwan were almost identical to those found in Southeast Asia, particularly Indo-China and Thailand. The island was divided into two very different regions - rugged, densely forested mountains and level, forest-cleared, alluvial lowlands. In the mountains dwelt war-like primitive tribes practising hunting and a primitive form of agriculture. The lowlands were occupied by people with a long tradition behind them of irrigation agriculture based on rice.

In the mountains, the Malay tribesmen carried on a shifting hoe culture on the steep mountain slopes combining it with hunting. They burned small clearings into the dense forests, planted their few crops, and when the soil became exhausted after a few years moved on to another part of their tribal territory. The lowlands showed the typical rice culture landscape - small farms, irrigated paddy fields, a dense population living in small nucleated villages, water buffaloes as the only beasts of burden and intensive use of human labour. No surpluses were raised, the majority of the farming being of a subsistence nature. On the terraced, lower mountain slopes near Taipei the Formosans grew tea in plantations - the only cash crop raised on the island.

On the frontier between the tribal territories and the rice culture of the lowland lived the Hakka frontiersman - part farmer, part woodsman. The frontier settlements gathered camphor from the mountain forests when they were not fending off raids by the head-hunters.

Communications on the island were practically non-existent. It took several weeks to traverse the lowland from north to south and the mountains, of course, were impenetrable. The lowlands in the eastern part of the island

were only sparsely settled. Trade with other areas was exceedingly small. In the international sphere it consisted of only tea and camphor shipped from the treaty ports of Tansui and Tainan. This trade was chiefly in the hands of the western merchants who dwelt in Taipei. Junks carried on a barter trade in local products and opium with Amoy and other ports of the Fukien coast.

The Japanese Period. Because of the poor communications as well as the hostility of the Formosans it took the Japanese six years to subdue the island. As soon as they had full control of the lowlands, the island's resources were organized under a colonial economy - that is, Taiwan's economic development was geared to the demands of the Japanese homeland. There were two stages in the Japanese exploitation of the island - between 1895 and 1935 Taiwan was a source of agricultural products, a supplier of raw materials; after 1935 the Japanese tried to make the island self-sufficient industrially in order for it to fulfill its role as an operational base for the invasion of Southeast Asia.

A. 1895-1935. In the early stages of the first period the western and Formosan merchants were stripped of their holdings. Japanese merchants and financiers in partnership with the government took over the operation of the major industries and the trade of the island. Communications were improved as rapidly as possible and within a short time the western plain was covered by a network of railways and roads. The government retained for itself the ownership of the forests. The camphor industry which had been ruthlessly exploiting the camphor forests was placed under a forest-managing government monopoly. Government monopolies were also applied to the production and trade in opium, tobacco, alcoholic beverages and salt.

The agricultural nature of the island was maintained but its character was changed. Under Japanese management the basic subsistence rice farming was modified to provide surpluses which were exported to Japan and Taiwan became a granary for the Japanese homeland. By providing sufficient imported commercial fertilizers and promoting the acreages planted to sweet potatoes and ground nuts, which crops augmented rice as the staple peasant food, Japan was able to obtain large rice surpluses. Taiwan rice made up about 20% of Japan's rice imports. Plantation crops - sugar cane, tea and pineapples - subsidized and protected on the Japanese market by tariffs, replaced a great deal of the acreage formerly planted to rice.

Industry and manufacturing were small, reflecting in part the paucity of industrial raw materials on Taiwan. Except for two machine works almost all the factories employed less than 20 hands.[1] By 1927 the Japanese controlled 78.4% of the capital invested in the island.

Trade from the beginning of the Japanese control was almost exclusively with the rest of the Japanese Empire. Taiwan exported its surplus food crops and other primary products and imported producer and consumer goods. Japan took roughly between 90 and 95% of the exports (Table 1) and supplied 85 to 90% of the island's imports. Of the exports which went

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[1] Foreign Commerce Weekly. Dec. 12, 1949. p. 41.

to countries outside of Japan in 1935, 61.3% was shipped to China and Hong Kong (sugar, coal), 29.7% to the United States (tea, camphor) and 9.8% to Southern Asia (tea).[1]

B. The Japanese Period 1935-1945. About 1935 the Japanese policy towards Taiwan was altered somewhat as preparations for expansion into Southern Asia began. In addition to Taiwan being a source of food for Japan it was now desired that the island become somewhat self-sufficient industrially in order to fulfill more adequately its position as an advance base of Japanese imperialism. As a result the production of minerals and foodstuffs was stepped up. Despite increased production of minerals Taiwan lacked the essential ingredients of iron and coking coal - for an adequate industrial base. Machinery and raw materials were imported from the rest of the Empire. Industry, particularly the metallurgy and metal working plants, was expanded. New plants were built and the capacity of the old ones increased.

In 1935 agriculture accounted for 53% by value of Taiwan's gross production industry for 38.9% and mining, 3.3%, (Table 2). In 1939 agriculture accounted for only 47.2% of the gross production value while industry and mining had increased to 44.0% and 4.3% respectively.[2] Despite the drive for self-sufficiency in metallurgy and metal working, industry was closely tied to agriculture.

In 1937 food processing (sugar refining and pineapple canning) was 70% of the island's manufacturing. The production of chemicals, mostly fertilizers, and industrial alcohol (from sugar refining processes and from dried sweet potatoes) accounted for another 10%. Metals and metal working were only 3% of manufactures. During the war the proportions were altered somewhat by an increase in the metallic industries. Attempts were made to grow commercial crops such as cotton and ramie in sufficient quantities to satisfy the Empire's demands.

The Japanese government tightened its control of the capital investment in the island. By 1939 90% of all the capital invested was held by the government and government-backed Japanese; the remaining 10%, held by Formosans, was mostly invested in small shops. Export trade beyond the Japanese Empire almost ceased. In 1937, exports to foreign countries amounted to only 2.7% of Taiwan's exports.[3] The trade was still in agricultural and other primary products. Imports from the non-Japanese areas increased slightly up to 1939. These were primarily raw materials for the expanding industries (e.g., aluminum ores and crude oil). Because of its colonial economy, Taiwan, throughout the Japanese periods showed a favourable balance of trade. In 1937, for example, imports were U.S. $92,743,000 while exports were U.S. $126,731,000.

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[1] Mitsubishi Economic Research Bureau of Tokyo. Japanese Trade and Industry: present and future. Macmillan and Co., Ltd., London. 1936.

[2] Mitchell, K. Japan's Industrial Strength. Institute of Pacific Relations. New York, 1942. p. 42.

[3] Schumpter, E.B. (ed.) The Industrialization of Japan and Manukuo, 1930-40. Macmillan and Co. Ltd., New York, 1940. p. 247.

During the war, production in all branches of human endeavour was increased to the straining point, especially in the manufacturing and mining industries. Machinery and equipment were worn out. Efficiency decreased despite higher production since the machines which had become obsolete were not replaced. After 1943 war damage resulted in major dislocations in some of the manufacturing industries which had been built for Taiwan's self-sufficiency.

In 1945, the Chinese accepted the surrender of the Japanese on Taiwan and took over control of the island's economy.

Chinese Period 1945-1948. The change in control from Japan to China brought little change in the outward appearance of Taiwan's economy. The Chinese government syndicates and monopolies replaced the Japanese government-backed corporations and monopolies. Practically all the exportable surpluses were now taken by China instead of by Japan. Internally, however, the island's economy began to crumble. Three interrelated factors contributed to this breakdown; - the damage and dislocation on the island resulting from the war, the disruption in the supply of imports - especially of fertilizers, and the administrative difficulties which developed.

Bomb damage seriously affected the production of the metallurgy plants, the oil refineries and the operation of the hydro-electric system. Much of the machinery in the mines and factories was either obsolete or worn out. The peak productions attained during the war dwindled to a mere dribble by 1946. Of more serious consequences was the decrease in imported fertilizers. Production of the two chief cash crops, sugar and rice (which formed over 80% of the exports), dropped greatly. Foreign exchange to re-equip the manufacturing plants and to provide the necessary aids to agriculture was tied up by the civil war raging on the mainland. Under Japanese management the island was run efficiently. When the Japanese were replaced efficiency disintegrated in the hands of inexperienced management. Inflation spread to the island. Discontent on the part of the Formosans led to the revolt of March, 1947. The revolt was put down and resulted in a change of government officials. Attempts were then made to re-establish industry and agriculture.

A rapidly increasing population further complicated the island's economy. Although about 400,000 Japanese were repatriated early in 1946 they were soon replaced by mainland Chinese fleeing the Communist armies. In addition, approximately 100,000 Formosans were repatriated from Japan.[1] The repatriated Formosans and the mainland refugees swelled the population of the cities and further strained the island's export capacity as domestic consumption had increased. Exports amounted to an estimated U.S. $17,228,000 and imports to U.S. $4,786,000[2] in 1948. The favourable balance of trade indicated by these figures presents a false picture for it was used by the Nationalist government on the mainland, little of it being applied to Taiwan.

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[1] Kerr, G. Formosa's Return to China. Far Eastern Survey, Vol. 16, No. 18, Oct. 15, 1947. p. 206.

[2] Foreign Commerce Weekly, Dec. 12, 1949.

Chinese Period after 1948. Early in 1949 the Nationalist government, driven out of the mainland by the Communist armies, took up residence in Taipei, capital of Taiwan. With the government came a horde of refugees and an army of almost half a million men. They increased the island's population by well over a million people, swelling the cities and towns to the bursting point.

Taiwan's economy was caught in a vicious whirlpool of circumstances which tended to prevent full recovery. First, Communist control of China meant the loss of the island's export market. Taiwan's cash crops and raw materials were thus forced onto the open world market. Here, saddled with high production costs due to more costly operations, worn-out machinery and in the case of sugar and rice lack of fertilizers, they could not face the open competition of the world's large commodity producers. Thus, foreign exchange could not be obtained by exports. Without foreign exchange to buy the fertilizers and machinery necessary for the rehabilitation of agriculture and industry high production could not be attained or even maintained at its previous level. Without a more efficient production to lower costs, open world competition for foreign exchange could not be met. Poor markets resulted in cut-backs in production of export producing industries; coal production, for example was reduced 40%.[1] The production cut-backs further reduced the island's ability to earn foreign exchange. Some help was provided by E.C.A. grants; but they were not sufficient to satisfy the needs.

In 1949 the dwindling exports were shipped mainly to Japan and the United States. Sugar, sent to Japan was the major export commodity. The products sent to the United States consisted primarily of canned pineapple and tea.

Despite all attempts to stabilize the currency, shortages caused by lack of foreign exchange and loss of markets continued to feed the inflation on the island. For example during the month of October, 1949, the general wholesale commodity price index rose 21.46%, the food index 19.93%, clothing 24.56% and the metals and electrical materials index 44.78%.

Lower rice yields due to lack of fertilizer combined with the inflation and the increased urban population caused Taiwan to change from a rice surplus region to a rice deficit region. Rice was in short supply in the cities early in 1950, being rationed in 109 urban centres although there was a slight surplus in the rural areas.

Despite the influx of urban dwellers, Taiwan is still primarily an agricultural region with its industry closely linked to its agriculture. Its economy, developed on a colonial basis, broke down completely when faced with open competition on the world's markets.

AGRICULTURE

In 1939 nearly 75% of the gainfully employed in Taiwan were engaged in agriculture. Agricultural products and processed foodstuffs accounted

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1 Foreign Commerce Weekly, Vol. 38, No. 6, Feb. 1950, p. 21.

for about 80% by value of Taiwan's production.[1] (Crops accounted for 47.2% in 1939 and processed foodstuffs for 31.7%.) Thus, the importance of agriculture to the island is self-evident.

When the Japanese took over the island, its population was relatively small. The area under cultivation in 1899 was estimated at 897,326 acres.[2] By 1939 the area of cultivated land had increased 2,124,000 acres or 24% of the island's total area. Some 94% of this land was in the western plain; 6.7% of the cultivated area was irrigated (about 1,310,000 acres).[1] Areas under irrigation are shown in Figure 13(a). Because of the favourable climate it is possible to obtain at least two crops a year from the land. Thus in 1938 although only 2,120,000 acres were under cultivation 2,947,000 acres were cultivated.[1]

Two major types of farming are carried on in Taiwan, excluding the bare subsistence shifting agriculture of the mountains. These are plantation farming and rice farming. Sugar cane, citrus fruits, tea, bananas and pineapples were grown on the plantations. No estimate of the area in plantations has been made but 30.1% of the cultivated land in 1930 was in farms larger than 12 acres.[3] Rice is grown on small farms, the average farm size being about 5 acres. In 1930 about 53% of the farmers cultivated less than 2.4 acres; about 30% farmed less than 1.2 acres.

About one-third of the land was controlled by 4.5% of the farm operators in the Japanese period.[4] This represents the plantation industry - large holdings and a few owners. Today the plantations are partly owned by the government. In 1936, 30.9% of the farmers owned the land they farmed, 31.3% owned part and rented part of their farm land, and 37.8% were tenants.[4] By 1949 the proportions had changed slightly - 33% of the farmers were owners, 28% part owners-part tenants and 39% were tenants. The tenants up to the middle of the century paid between 50 and 75% of their crops as rental for the land. Legislation late in 1949 reduced rentals to a maximum of 37.5% of the crops raised, alleviating to a certain extent the impoverished condition of the tenant farmers. In 1939, 61% of the irrigated farm land was tenant operated,[3] that is, almost all the rice farms were operated by tenant farmers. Of the non-irrigated or upland crop land only about 40% was tenant operated. The smallest farm units are located in those areas where double cropping is carried on.

On double cropping farms the first crop is planted in February or March and is harvested in June or July. The second crop is usually planted in July or August and harvested in October or November. Double cropping

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[1] Moyer, R.T. Agriculture and Foodstuffs in Taiwan. Foreign Agriculture, Vol. 9, No. 1, January 1945, p. 4.

[2] Schumpter, E.D. ed. The Industrialization of Japan and Manchukuo, 1930-1940. Macmillan Co. New York, 1940. p. 295.

[3] Moyer, R.T. op. cit. p. 5.

[4] Pelzer, K.J. - Population and Land Utilization, Institute of Pacific Relations. New York, 1942. p. 126.

is carried on in both irrigated and upland fields. Of the 1,310,000 acres of irrigated land some 799,000 acres can be irrigated for both crops[1] (Table 3), only 28,000 acres can be irrigated just for the first crop and the remaining 483,000 acres can be irrigated only when the second crop is being grown. Most of this last mentioned area is to be found in the dry west-central part of the western plain, - the area with the least rainfall.

The rice farmer ekes out a bare existence, his standard of living being below that of the Japanese farmer. Rice is the main crop and during the Japanese period was raised primarily for cash. Sugar cane, sweet potatoes, peanuts and vegetables formed the second crop, usually being planted about thirty days before the rice harvest. Every other row of rice plants was removed to make room for the second crop and the paddy field (i.e., rice field) drained. In some parts of the central and southern sections of the western plain three crops a year are obtained from the soil - two successive rice crops and one of either wheat, vegetables or beans. The use of hand labour is very intensive there being little animal power available. What draught animals there are for power are almost all water buffaloes. Swine and poultry are kept on almost each farm. These animals are natural scavengers so there is little competition with men for the use of the land. During the Japanese periods the success of the agricultural program was due to the wide use of fertilizers - green, barnyard, domestic and imported mineral. The island's agriculture as a whole requires about 250,000 metric tons of fertilizers. In the post-war period consumption of fertilizers dropped to less than 50% of needs. Reduced yields and production resulted. The small farmer who had formerly subsisted on sweet potatoes, peanuts and vegetables, selling his rice for cash, now because of lower yields had less and less surplus rice to offer for sale.

The dearth of fertilizers was more damaging to the plantation crops. This factor of low yields due to lack of fertilizers, combined with low world market prices has resulted in cut-backs of as much as 40% in the plantation crop acreage.

The crops of Taiwan fall into two categories - those raised for food and those raised for cash. The latter form the bulk of the exports. Rice and sweet potatoes are the staple foods of almost the entire population. They are augmented by peanuts, vegetables and grains other than rice. Sugar cane is the chief cash crop and export. During the Japanese period rice and sweet potatoes were also raised in part for cash. The only other cash crops of importance are the plantation crops - tea, pineapples, bananas and citrus fruits. Predominant crop areas are shown in Figure 13(b).

Food Crops

Rice: Rice occupies just over 50% of all Taiwan crop land (Tables 4 and 5). The area occupied increased from 417,600 acres in 1899 to 583,000 acres in 1922[2] and about 900,000 acres in 1939[3] when production of all com-

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[1] Moyer, R.T. op. cit. p. 4.

[2] Schumpter, E.B. ed. op. cit. p. 295.

[3] Moyer, R.T. op. cit. p. 6.

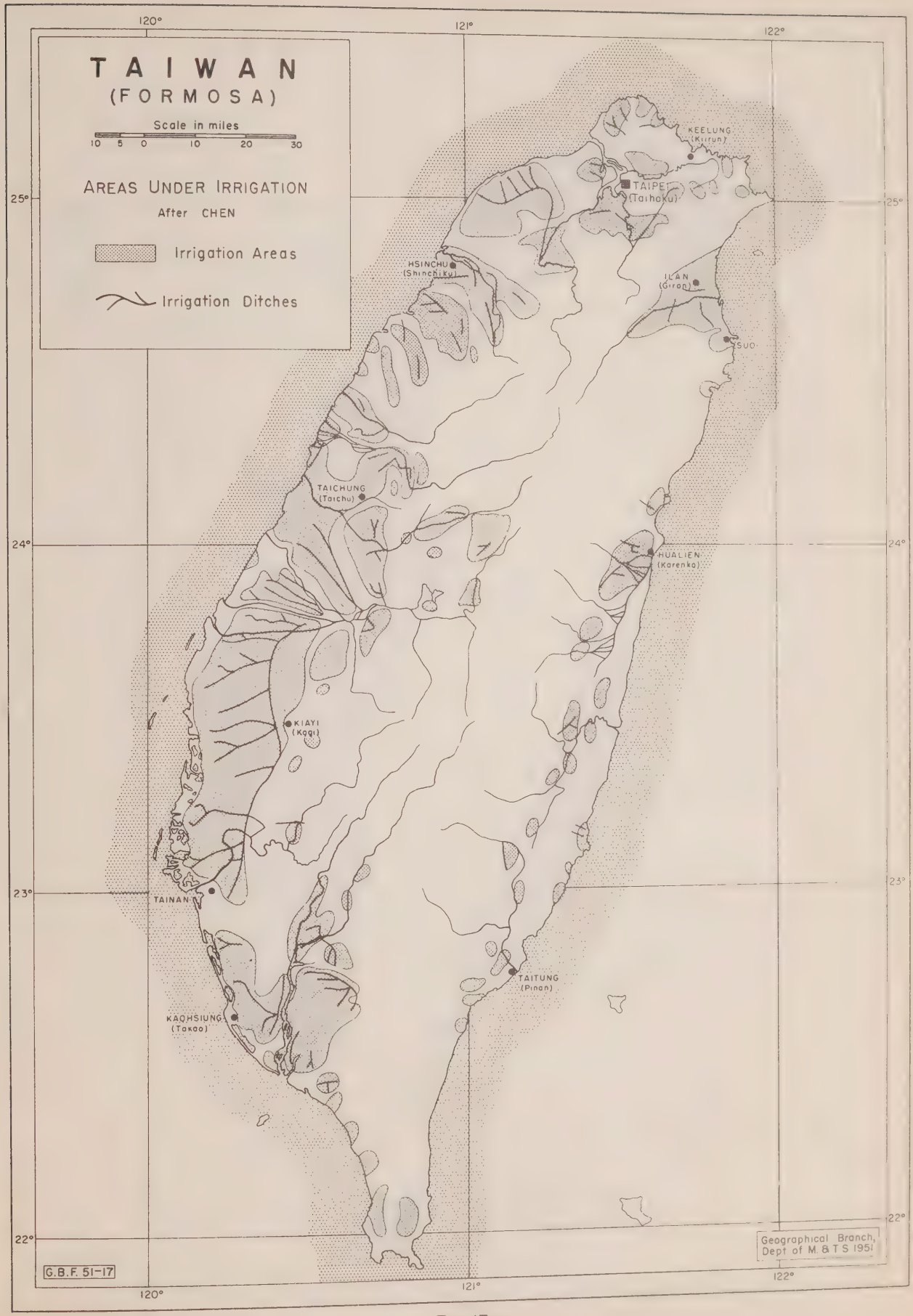
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
AREAS UNDER IRRIGATION
After CHEN
Irrigation Areas
Irrigation Ditches
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kogi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
G.B.F. 51-17
Geographical Branch, Dept of M. & T S 1951

FIG. 13a

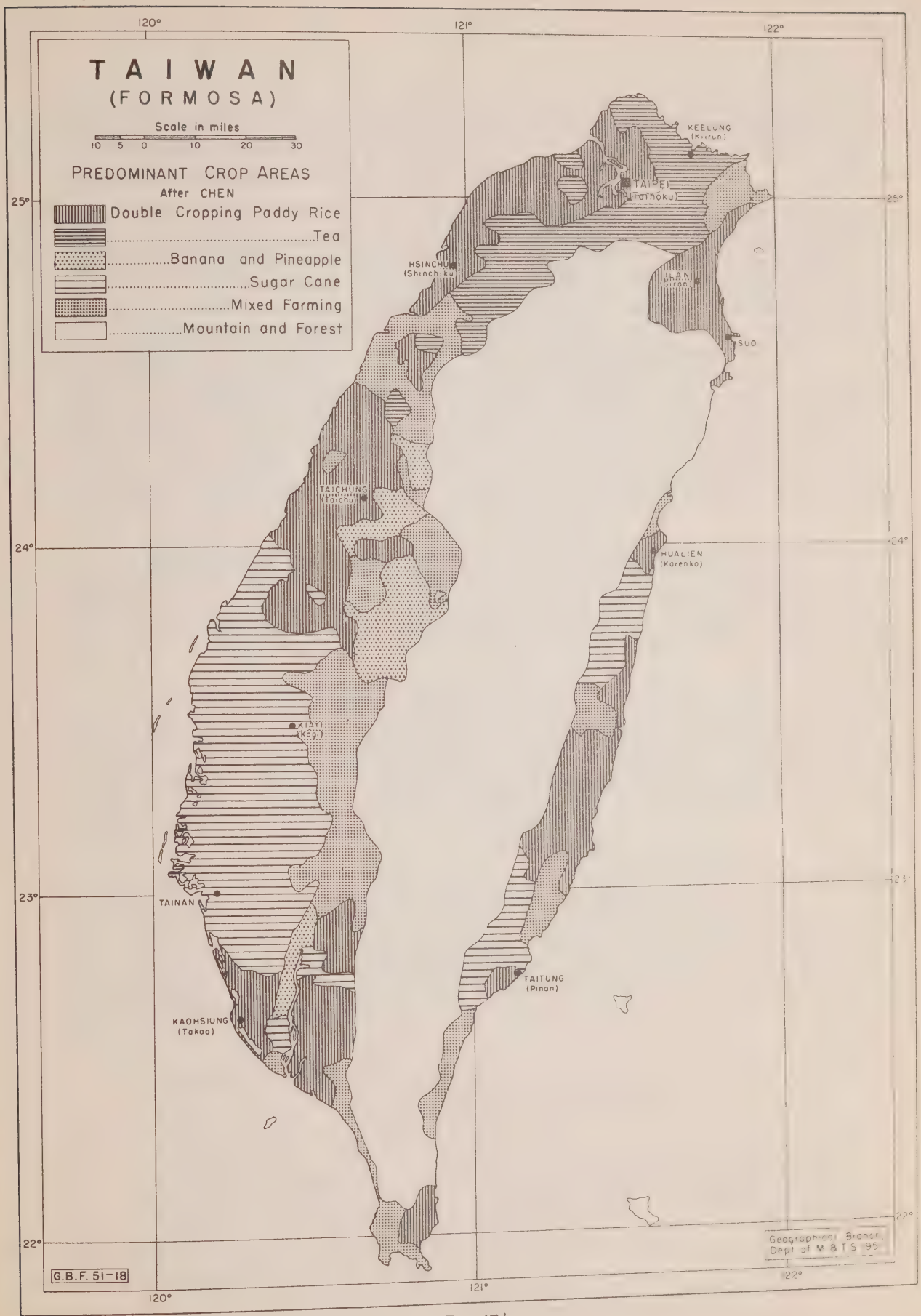
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
PREDOMINANT CROP AREAS
After CHEN
Double Cropping Paddy Rice
Tea
Banana and Pineapple
Sugar Cane
Mixed Farming
Mountain and Forest
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kogi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
G.B.F. 51-18
Geographical Branch
Dept of M.B.T.S. 95

FIG. 13b

modities was increased. The area planted to rice in 1939 was 1,547,000 acres,[1] 43% being first crop. The post-war period saw a slight drop in the area planted, the acreage being 1,454,830 acres in 1947.[2] The acreage planted to rice in 1948-9 was about the same as in 1947.

Less than 4% of the 1939 production was upland rice, the acreage for Taiwan being 59,000 acres. Most of this acreage is in the dry regions of Tainan district where upland rice forms 10% of the total rice area. Rice is the most important crop in every district of the island forming the staple food and major cash crop of the small farmer. The yields during the Japanese period was quite good averaging 52.8 bushels per acre in 1939. This compared favourably with yields in other Asiatic areas - 75.4 bushels per acre in Japan, 50.3 bushels per acre in China and 26.5 bushels per acre in Burma.[3] The yield in 1947 was 41 bushes per acre,[4] showing the effect of the fertilizer deficiency. Total production was reduced from its pre-war average of about 1,600,000 metric tons to 1,200,000 metric tons.[4] During the Japanese period about half of the rice crop was exported to Japan. Higher domestic consumption coupled with lower yields has eliminated any exportable surplus in the post-war period.

Sweet Potatoes: This crop forms one of the staple foods of the peasantry. It was grown on the island prior to the Japanese period but as more and more land was utilized for cash crops the acreage of sweet potatoes, which crop has a very high yield per acre, was increased rapidly. By 1930 the acreage planted to sweet potatoes was thirteen times that of 1895.[5]

Generally speaking the soils utilized were medium to light in texture. Only about 4% of the acreage in 1938 was on irrigated land since the crop is grown almost entirely on upland fields. Sweet potatoes are grown in every district of the island but about 40% of the entire crop is raised on the drier parts of Taiwan district.[6] The average acreage planted in sweet potatoes in Taiwan was 350,000 acres during the period 1935-39, about 13% of the area planted to crops each year.

About 60% of the production, which average 1,790,000 short tons in the years 1935-39, was used as fresh food for human consumption. Some of this portion of the production was also fed to swine. The remaining 40% was dried and used in the production of industrial alcohol and starch. The increase in domestic rice consumption, combined with war damage to the alcohol plants has resulted in a marked decrease in sweet potato acreage in the post-war period.

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[1] Moyer, R.T. op. cit. p. 6.

[2] U.N. F.A.O. Rice Bulletin, February 1949, p. 60.

[3] Moyer, R.T. op. cit. p. 7.

[4] United Nations, F.A.O. Rice Bulletin, February 1949. p. 60.

[5] Hall, R.B. Agricultural Regions of Asia. Economic Geography, Vol. 10, No. 4.

[6] Moyer, R.T. op. cit. p. 8.

Peanuts: These are grown on sandy soils throughout the agricultural parts of the island, although the heaviest concentration is in the drier parts of the western plain. In 1900 the acreage in peanuts was 2,940 acres.[1] By 1936 this acreage had increased to 77,635 acres. The average annual production from 1931 to 1936 was 50,000 metric tons.[2] About 25% of the crop was pressed for oil.

Grains other than rice: Wheat, barley, millet and sesame are grown in small quantities. In the south these grains are often the third crop, i.e., a dry winter crop grown after two successive rice crops.

Vegetables: Fresh vegetables form an important part of the Formosan's diet. The principle types grown are Daikon radishes, cabbages, Taiwan rape, garlic, taros, onions, melons, gourds, celery, cucumbers, leeks, egg plant, string beans, peas, cassava and pumpkins. In 1939, 96,900 acres were planted to these vegetables.

About 24,000 acres of beans of all types were grown in 1939, half the acreage being in Tainan district.[3]

Fruit: Longans, pomegranates, citrus fruits, pineapples and bananas are grown everywhere for domestic consumption (Table 6). In the north, the temperate fruits - plums, peaches, persimmons and grapes - are raised as well.

Farm Animals

Each farm has swine and poultry. In 1939 the average was 2.9 swine and 21 birds per farm household.[4] The comparable figures for Japan are 0.2 and 9.5 and for South China 1.1 and 5.5.[4] The estimated total livestock population of the island in 1946-47 is as follows: goats - 183,000,[5] water buffaloes, the island's beast of burden - 225,000,[5] chickens - 4,576,000,[5] ducks - 1,977,000,[5] geese - 390,000,[6] turkeys - 42,000,[6] swine - 1,653,000,[6] horses - 1,000,[5] dairy cattle - 76,000.[5]

Cash Crops

Sugar Cane: Sugar cane is the most important cash crop in Taiwan. During the Japanese period it provided over 50% of the island's total exports (Table 1). Almost the entire crop was exported, little being used locally. The growing of sugar cane was introduced by the Chinese and Dutch prior to 1895. When the Japanese took over Taiwan they rapidly increased the sugar acreage and improved the varieties grown. The sugar plantations were highly mechanized being served by 51 modern mills and 1,500 miles of narrow gauge railway in 1939.

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1 The Japan Year Book. op. cit. p. 975.

2 Moyer, R.T. op. cit. p. 9.

3 Moyer, R.T. op. cit. p. 8.

4 Moyer, R.T. op. cit. p. 10.

5 U.N., F.A.O. Yearbook of Food and Agricultural Statistics, Vol.I: Production 1948.

6 1939 total, R.T. Moyer. op. cit. p. 10.

The sugar cane is planted from June to November on both irrigated lowland and upland soils and harvested from 12 to 20 months later. The acreage planted, at all times - pre-war and post-war - depended on the demand for sugar. The crop can be grown almost anywhere on the agricultural land of the island but the greatest acreage is on the western plain south of the Tainan River. During the post-war period about one-third of the sugar crop was raised on government plantations and about two-thirds on small farms.[1]

The acreage planted to sugar cane in 1902-3 was 89,000 acres[2] and the yield per acre quite low. The 1934-38 average acreage was 287,000 acres.[3] Dislocation because of the war resulted in only 89,000 acres of cane being planted in 1946.[3] Within the next few years this acreage was increased to about 150,000 acres per year. Low world prices resulted in lower sales and many farmers were left with unsold crops in 1949. This brought about a reduction in the acreage planted the next year. As a result the government-owned sugar syndicate has been obliged to subsidize the planting of cane in order to ensure a sufficient crop for profitable operation in 1950-51.[4]

Production in the post-war period has been greatly reduced because of the lack of fertilizer. Yields in the period 1934-8 averaged 2.96 short tons of cane per acre while in 1946 the yield was 1.24 short tons of cane per acre.[5] Except for the period 1945-1948 Japan has taken almost all of Taiwan's export sugar.

Tea: The commercial growing of tea on Taiwan began in 1868. The Japanese took over the operation of the tea plantations in 1895 and rapidly increased the acreage as well as greatly improving their operational efficiency. The tea plantations are all found on the terraced, steep hillsides of Taipei and Hsinchu districts. The area covered is about 111,000 acres. Annual production in the period 1934-38 averaged 11,553 metric tons.[6] (Tables 4 and 5). The entire crop was exported - 10% going to the Japanese Empire and the remaining 90% (of which United States took the major share) to the rest of the world. Wartime neglect and the lack of fertilizers and insecticides in the post-war period reduced the tea acreage to 55,833 acres in 1946.[7] Production was revived somewhat by 1948 when 9,600 metric tons were produced. In 1948 tea made up 58.8% of Taiwan's exports to the United States (value - U.S. $1,040,000).[7]

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1 Gage, E. Industrial Development in Formosa. Economic Geography, Vol. 26, No. 3, July 1950. p. 48.

2 The Japan Year Book 1938-9, op. cit. p. 977.

3 United Nations. F.A.O. Yearbook of Food and Agricultural Statistics, Vol. 1. Production 1948.

4 Foreign Commerce Weekly. Vol. 37, No. 11. Dec. 12, 1949.

5 F.A.O. Yearbook of Food and Agricultural Statistics, op. cit.

6 United Nation, F.A.O. Yearbook of Food and Agricultural Statistics., op. cit.

7 Foreign Commercial Weekly, Dec. 12, 1949.

Bananas: This fruit can be grown anywhere on the island and before the Japanese period was grown locally for domestic consumption. The Japanese planted large plantations to provide bananas for the Japanese home market. From 1937 to 1944 the area in bananas averaged 46,000 acres and the annual yield was about 150,000 short tons. Wartime neglect, the post-war loss of markets and lack of proper shipping have destroyed the banana's value as an export crop. In 1948 the estimated acreage in bananas was 35,000 acres with the yield being about 78,000 short tons. Domestic consumption is estimated at 50,000-60,000 short tons per year. Over half the banana plantations are located in the foothills region of Taichung district. There is also a large acreage grown under irrigation in Kaohsiung district.

Pineapples: Like bananas and citrus fruits, pineapples were cultivated on Taiwan before 1895. The Japanese developed a pineapple canning industry shortly after 1910, growing the fruit on plantations. Peak production was reached in 1939 when 26,000 acres were planted to pineapples.[1] Over half of this production was in Taichung district.

The entire plantation pineapple crop was exported to Japan. Loss of markets after 1945 brought a decrease in acreage. Farmers who grew pineapples under contract with the canneries began to grow cassava instead of pineapple because its yields were three times more valuable than pineapples. After 1948, insufficient capital for operations has resulted in almost the complete elimination of the pineapple plantations.[1]

Citrus Fruits: Tangerines and pomelos were grown on plantations for the Japanese market after 1895. The annual average acreage of the citrus plantations is 12,000 acres, the groves being mostly in Taipei and Hsinchu districts. In 1947 the yield of the citrus groves was 29,500 short tons.[1] The loss of markets after 1948 has seen a drop in production.

Other Cash Crops: The growing of tobacco, jute and sisal was promoted by the Japanese during the second phase of their occupation of Taiwan. This policy, aiming at self-sufficiency, was continued by the Chinese, especially after 1948. Tobacco growing is controlled by a government monopoly. Annual consumption on the island is about 4,000 metric tons. This demand is met and after 1949 a surplus was available.[1] In 1948 the tobacco acreage was 9,710 acres and the yield was 3,365 metric tons.[1]

Almost all attempts to grow cotton have ended in failure. The climate and insects have combined to ruin almost every crop. Greater success has attended the growing of jute, but production of this important fibre, 13,500 metric tons in 1948, was only 25% of the island's requirements. The production of sisal and ramie on the island is quite small and far short of the necessary requirements.

Agricultural Regions

Taiwan can be divided roughly into five major agricultural divisions, each somewhat different basically from the others. Figure 13(c).

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[1] Foreign Commerce Weekly. Dec. 12, 1949.

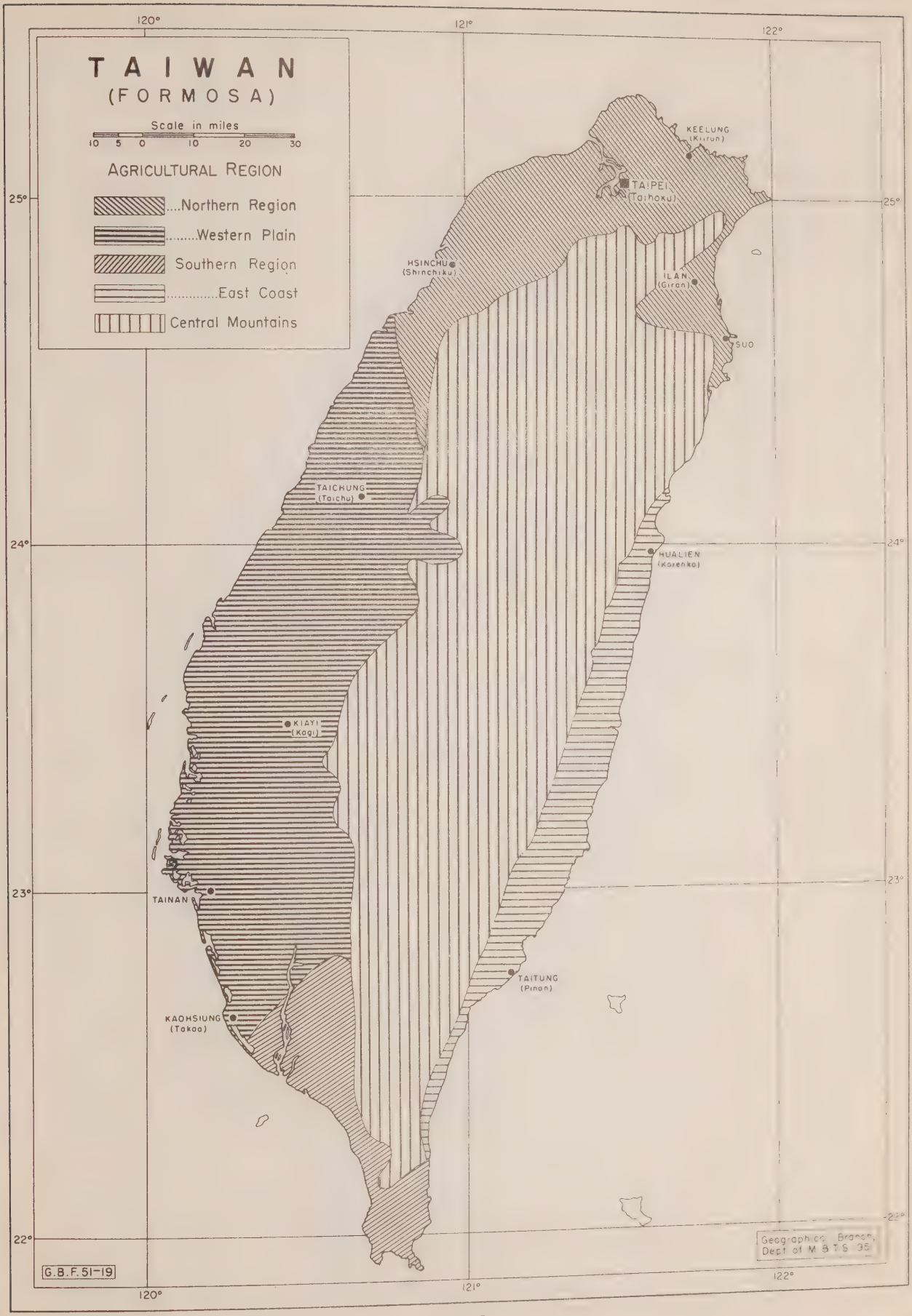
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
AGRICULTURAL REGION
....Northern Region
.....Western Plain
Southern Region
.....East Coast
Central Mountains
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kiirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
Geographics Branch,
Dept of M.S.T.S. 35
G.B.F. 51-19

FIG. 13 c

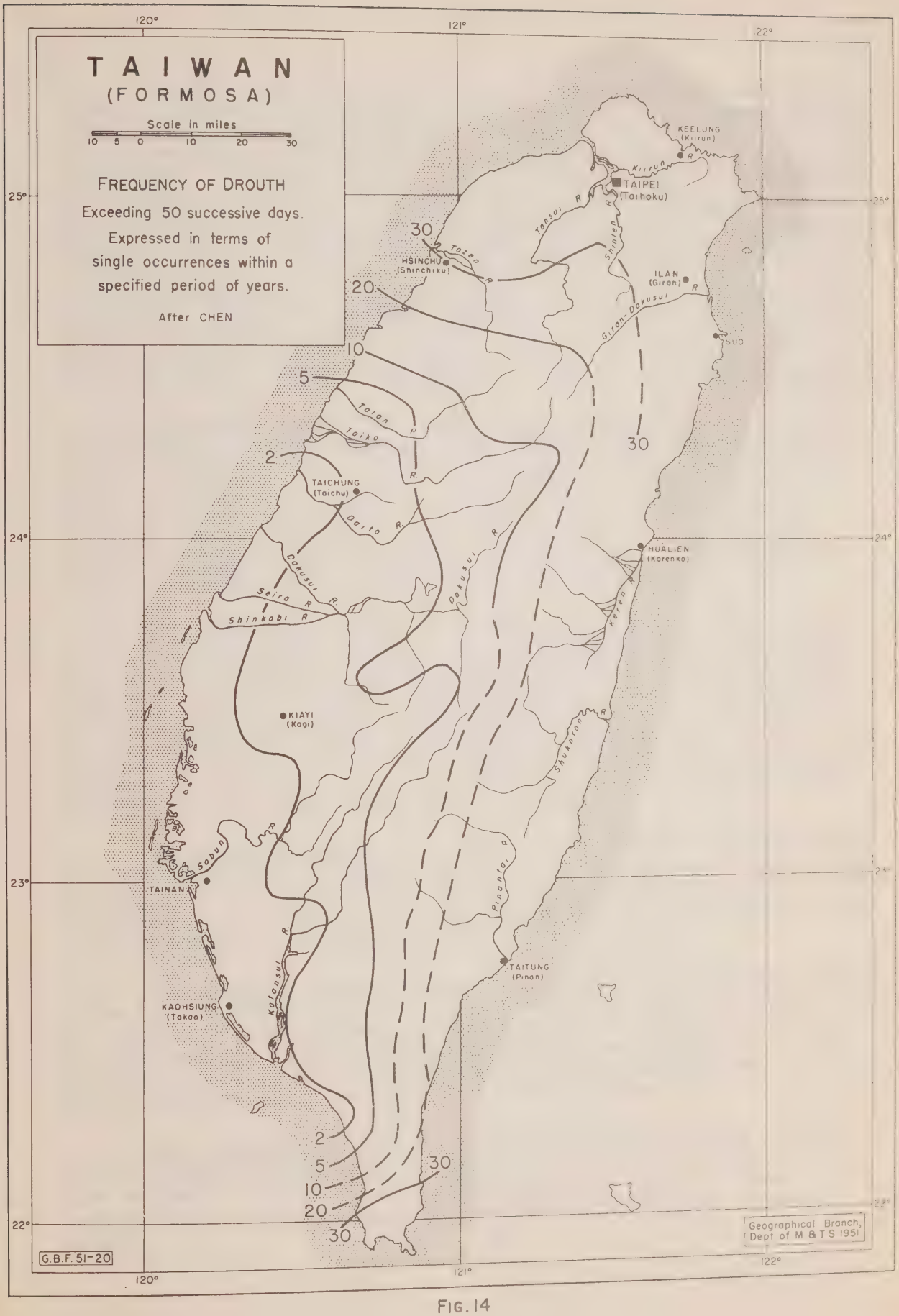
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
FREQUENCY OF DROUTH
Exceeding 50 successive days.
Expressed in terms of
single occurrences within a
specified period of years.
After CHEN
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kiirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
HUALIEN
(Korenko)
TAICHUNG
(Taichu)
KIAYI
(Kagi)
TAINAN
KAOHSIUNG
(Takao)
TAITUNG
(Pinan)
Tanshui R.
Shinten R.
Totsen R.
Giran-Daokusui R.
Toian R.
Toiko R.
Daito R.
Daokusui R.
Seiro R.
Shinkobi R.
Keren R.
Shukuran R.
Pinanlai R.
Kaoansui R.
Sobun R.
30
20
10
5
2
G.B.F. 51-20
Geographical Branch,
Dept of M & T S 1951

FIG. 14

The Northern Region. This region corresponds roughly to two of the climatic regions, the Northeastern and the Northern. It is characterized by rainfall all year round, although the maximum fall is in the winter in the northeast and in the summer in the southwest. Drouths are infrequent (Figure 14). Although the region has the coolest winter of any agricultural area on Taiwan two crops can be grown each year. The landscape consists of terraced hillsides and irrigated lowland paddy fields. On the terraces are the citrus fruit and tea plantations, the source of the area's major cash crops. In the north of the region numerous shelter belts dot the lowland countryside - evidences of the influence of the prevailing northeast winds. Rice, sweet potatoes, peanuts and vegetables are grown for domestic consumption. There is little surplus. Some sugar and tobacco are grown as cash crops, but the acreage is not great. The temperate fruits - plums, persimmons, peaches and grapes - are grown for domestic consumption.

The Western Plain. This agricultural region includes most of the western plain and is the granary of the island. Over two-thirds of the rice and sugar cane are grown on the irrigated fields which cover the plain. At least two crops a year can be raised - this despite a distinct dry season. Over 80% of the rainfall occurs between April and September. As a result of this dry season drouths are frequent (Figure 14), occurring almost every five years in the eastern part of the region and almost every second year in the drier coastal sections.

The landscape is characterized by irrigated plantations and paddy fields and tilled upland fields. The upland fields produce the upland rice, sweet potatoes and peanuts, whereas the paddy fields produced the rice formerly sent to Japan. Sugar cane plantations with their attendant refineries and narrow gauge rail networks cover the plain (Figure 17). In the north about Taichung are the export fruit plantations - bananas, and pineapples, and some citrus fruits. Plums and persimmons are also grown in the northern part of this region. A unique feature of the coastal portions are the fields devoted to fish farming.

The Southern Region. This region has the warmest winters on Taiwan and as a result at least three crops a year can be grown - two rice crops followed by a dry winter crop. The area is characterized by subsistence farming with a concentration of sugar plantations occurring in the north, on the plain about the Katansui River.

The East Coast Region. Agriculture in this region is almost completely of the subsistence type. In the coastal mountains the Ami tribesmen carry on a semi-sedentary shifting cultivation while the lowlands of the Hualien-Taitung Trench are covered with the paddy fields of the subsistence rice farmers. In the north of the region there are some sugar cane plantations along the banks of the Keren (Hualien) River.

Central Mountains. Only a few small fields cultivated by the shifting Malay tribesmen show the presence of man in the rugged forest-clad mountains. To all intents and purposes this region is devoid of agriculture, the boundaries of the area indicating the limit of agriculture.

FORESTRY

The total area of forest in Taiwan is 6,158,975 acres or 68% of the island's area.[1] Approximately 20% of this forested area is in shrubs and brush, the remainder being woodland. Some 95% is public domain, government control of the island's forests dating from the beginning of the Japanese period. Almost half of the forested region lies between 6,000 and 12,000 feet above sea level. The coniferous forests, which are the sources of the most merchantable timber and pulpwood, are on the upper slopes of the mountains.

Accessibility is the factor which controls the exploitation of the island's timber potential. Because of poor communications in the mountain areas and the fact that the best timber is on the highest slopes, the forest resources have been only slightly developed. Of the 7,328 million cubic feet of timber which is accessible, 4,540 million cubic feet is in coniferous species and 2,788 million cubic feet in broad-leaved species.[2] Exploitation of the forest resources is of three types - timber production, pulp production and camphor production.

Timber Production. Production of timber during the Japanese period varied considerably, (e.g., it was 35 million board feet in 1936 and 226 million board feet in 1940.[2] Because of the inaccessibility of the timber areas the annual production supplied only about 50% of the island's timber needs - this despite the fact that trees are the one resource Taiwan has in great quantity. Post-war production has decreased considerably because of the lack of equipment replacements. The number of operating sawmills of all sizes has been reduced from an estimated 460 to 264[3] by wartime damage and post-war dislocation. Most of the timber comes from the mixed forest areas, the major varieties cut being cedar, hemlock, and Mongolian oak. Despite the fact that the major part of the island is wooded there are only three areas where lumbering is carried on.

1. Arisan: This lumbering area covers an area of 27,200 acres on the slopes of Mt. Arisan, east of Kiayi. Forestry operations are carried on in the coniferous forests at elevations rising to 9,000 feet. The coniferous forests of Taiwan are amongst the best stands of timber in the world. The average height of trees in the Arisan forest is 150 to 200 feet and the average girth is 22 feet. The trees, especially the cedars, are amongst the tallest and oldest in the world. (In age, they average 1,000 to 3,000 years).[2] The timber camps are connected to the sawmills and paper mills in Kiayi by a tortuous 41 mile long, narrow-gauge railway line.

2. Hassenzen: This lumbering region is in the mountains east of Taichung. The area covered by lumbering operations is 39,700 acres and as in the Arisan forest the major varieties cut are from the mixed forests.

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[1] Munn, G.W. Forestry and Forest Resources of Formosa (Taiwan). Australian Forestry, Vol. 12, No. 2, 1948. p. 112.

[2] Idem. p. 113.

[3] Munn, G.W. op. cit. p. 119.

3. Dakusui Valley: The mountain slopes which rim the plain of Ilan provide a forest reserve of 156,100 acres. The coniferous forests within this area are being exploited. Roto, on the plain about 8 miles south of Ilan is the major mill town for Dakusui timber.

Pulp Production. Paper making was established on the island by the Japanese at an early date. Three sources of pulp are used - softwood logs, bamboo and sugar cane waste. Hemlock, spruce and pine cut in the three lumbering areas, are the major species used. Bamboo, cut in the Western Foothills, and bagasse (the cane waste from the sugar refining processes) provide 47% of the pulp used in paper making.

Camphor Production. Camphor and camphor oil are obtained from the destructive distillation of wood chips from the camphor tree (Cinnamomum camphora). Taiwan is the world's largest producer and major source of natural camphor. Since 1895 production has been under government monopoly, first Japanese and then Chinese. During the Japanese period almost the entire crude camphor production was sent to Japan for refining and for distribution to the world. Camphor and camphor oil provided only about 2% by value of Taiwan's total exports. (Table 1)

The camphor forests are found on the lower mountain slopes in the tribal territories. The Hakka frontiersman who gathers the camphor has had to be almost continually protected by troops from the predatory raids of the head-hunters. Since 1935 the natural camphor industry has been in the throes of a depression. The former Japanese monopoly in the supply of camphor forced other nations to develop the synthetic manufacture of the material, particularly during the Second World War. Taiwan's annual production in the early thirties was about 3,000 metric tons, 70% of the world's production[1] - all of which was exported. In 1949, when the market for natural camphor had been destroyed by the synthetic product, Taiwan's exports amounted to only 30 metric tons.[2]

Fuel Wood Production. Wood produced for fuel on the island was quite low being estimated at about 900 cords in 1936.[3] Coal and electricity are the major sources of power.

Poor communications, partially attributable to the difficulties inherent in the island's physiography, have seriously affected the exploitation of forest resources on Taiwan. Forest products contributed a small share to the island's gross production (Table 2). Similarly lumber products were a small proportion by value of all manufactures (1.4% in 1937). The serious decline of the camphor gathering industry coupled with the lack of proper machinery for lumbering operations have made the role played by forest products in Taiwan's economy relatively minor in recent years.

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[1] The Japan Year Book 1938-9, op. cit. p. 987.

[2] Foreign Commerce Weekly, March 6, 1950.

[3] United States, Dept. of State. Energy Resources of the World. Washington, 1949.

FISHING

The Formosans augment their diet of agricultural products with fresh fish. The gross value of the fisheries products is, however, quite small when compared to agriculture and manufacturing (Table 2). In 1921 it was 2.6% of total production and in 1939 2.5%, although fish production had increased from about 33,000 short tons in the early twenties to 88,000 short tons in 1939.

There are two major sources of production - the seas about the island and fish ponds along the western coast (Figure 15). About 20% of the annual catch is produced by fish farming - i.e., the propogation of fish in the fish hatcheries and in the ponds which form in the irrigated paddy fields. Fish are thus considered a food crop and in 1938 the area covered by fish farms was 66,851 acres, an acreage which ranked fifth in the total crop land of the island. The sea fisheries are mainly deep sea fisheries, the major catches being made in the waters of the Kuro Siwo. Bonito, tuna, spearfishes and sharks form a large proportion of each catch. Tuna and spearfish either follow the flow of the Kuro Siwo or remain all year in the Ryukyu fishing grounds northeast of Taiwan. The major shark fishing grounds are in the deep waters off the east coast of the island (Figure 15). Large fish are caught by long lines. Tunney, sturgeon, red snappers, shrimp, lobsters and many other species are also caught in quantities. A few whales are killed each year in the waters about the southern end of the island. Most of the year's catch is made during the winter season in the waters off the east coast. Keelung on the north, Kaohsiung on the southwest and Suo on the east coast are the chief commercial fishing ports.

About 200,000 people are engaged in the fishing industry, two-thirds of them on a part-time basis. In 1899, 20,671[1] people were exclusively engaged in fishing. In 1947, the number of full-time fishermen was 69,521.[2]

MINING

At the present time Taiwan is not known to be very rich in mineral resources. Most of the mountainous areas have as yet been inadequately explored geologically. The production of the mining industry in 1939 was 4.3% by value of Taiwan's total production (Table 2). The mining industry includes the production of petroleum, natural gas and coal of the generation, and the production of power, gold, copper, sulphur and solar salt. By value the most important production is of gold and coal (Table 7).

Production peaks in the mining industry occurred during the Second World War. Increased production during the war had an adverse effect on post-war production as machinery and equipment became worn out and difficult to replace. Wartime bomb damage, inexperienced management and lack of foreign exchange in the post-war period have all contributed to the decline of the mining industry following the Japanese surrender.

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[1] Statistical Summary of Taiwan, 1912. p. 216.

[2] Foreign Commerce Weekly. Dec. 12, 1949.

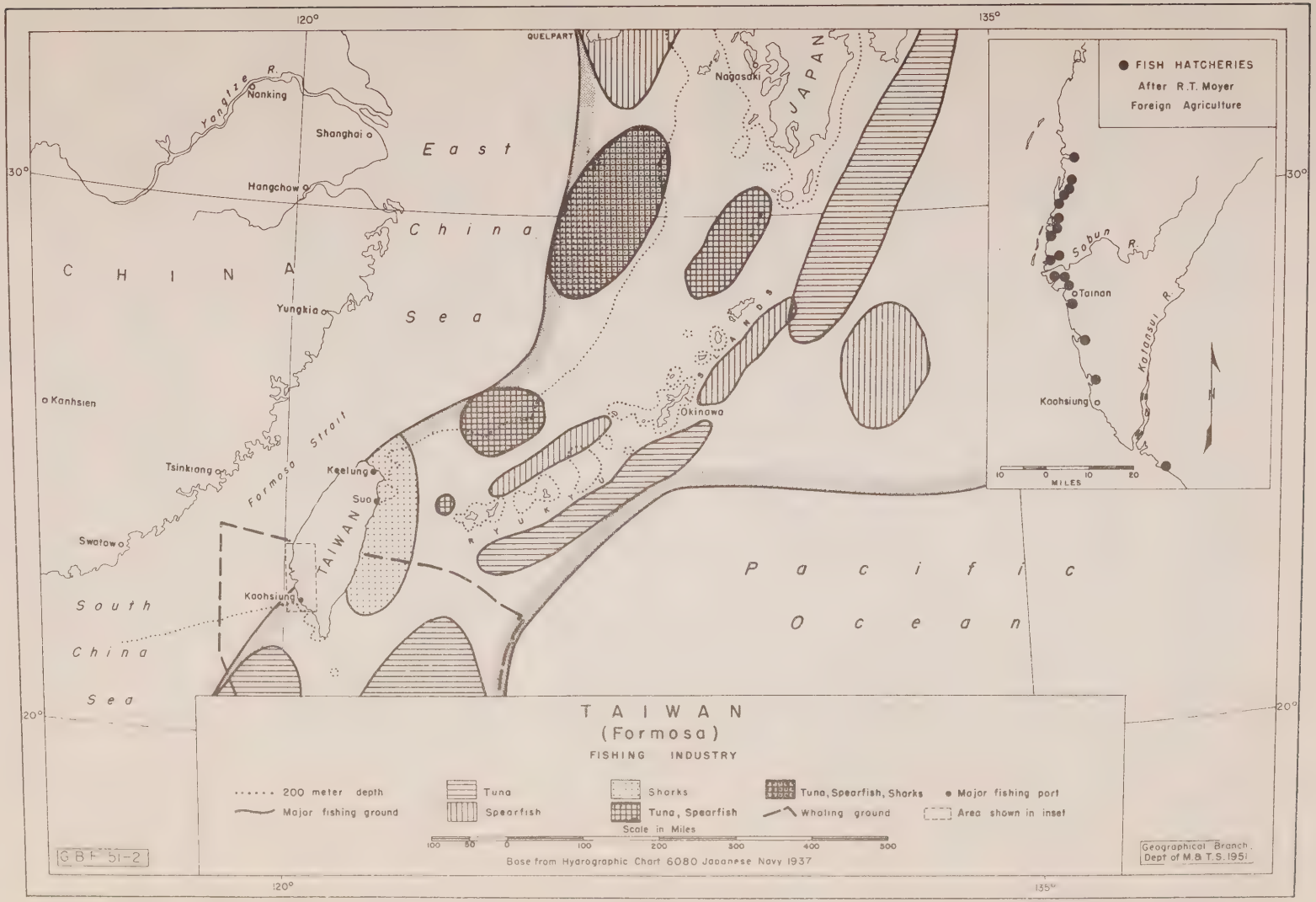
120°
135°
30°
20°
QUELPART
Nagasaki
JAPAN
Yangtze R.
Nanking
Shanghai
East
China
Sea
Hangchow
CHINA
Yungkia
Kanhsien
Formosa Strait
Tsinkiang
Keelung
Suo
TAIWAN
Swatow
Kaohsiung
South
China
Sea
Okinawa
RYUKYU
Pacific
Ocean
FISH HATCHERIES
After R.T. Moyer
Foreign Agriculture
Sobun R.
Tainan
Kaohsiung
Kaoping-sui R.
N
10 0 10 20
MILES
TAIWAN
(Formosa)
FISHING INDUSTRY
200 meter depth
Major fishing ground
Tuna
Spearfish
Sharks
Tuna, Spearfish
Tuna, Spearfish, Sharks
Whaling ground
Major fishing port
Area shown in inset
Scale in Miles
100 50 0 100 200 300 400 500
Base from Hydrographic Chart 6080 Japanese Navy 1937
GBF 51-2
Geographical Branch,
Dept of M.& T.S. 1951

FIG. 15

Mineral Fuels

Coal: Low grade bituminous coal beds are found in the Tertiary shales of the northeastern part of the island (Figure 12). The coal seams are from 1 to 2 feet thick and strike northeast-southwest. Reserves are estimated at 440,000,000 metric tons.

Production began before 1895 near Hatto. In 1936, 39.6% by value of the island's mineral production was of coal. There are 13 major coal mines on the island, all but two being in the Taipei-Keelung region (Figure 12). The average annual production was between 1,500,000 and 2,000,000 metric tons, (about 0.1% of the world's total).[1] Peak annual production during the war totalled 2,800,000 metric tons. Prior to 1945 about half of the coal produced was not required for domestic use. During the Twenties this surplus went to Hong Kong and China; during the Thirties and the Second World War to Japan; and from 1945 to 1948 to the Chinese mainland. Production declined sharply after 1945 but climbed to 1,649,000 metric tons by 1948.[2] The loss of the mainland markets after 1949 has resulted in a cutback in production of 40%,[3] a tonnage equivalent to the annual exports to the mainland. Coal is the source of some of the island's electric power, as well as being used for domestic purposes and bunkering (i.e., for ships). Although generally speaking, Taiwan coal is poor for coking, some such coal is available at Shiodome and Itabashi.[4]

Petroleum and Natural Gas: Crude oil and natural gas are produced from the sedimentary rocks of Tertiary Age on the western plain and in the foothill regions. The area of probable oil reserves, that is the area within which oil fields have been discovered, and the areas of possible oil reserves, that is the areas where the rock types are considered capable of storing oil, are shown in Figure 16.

The Taiwan crude oil is rich in gasoline, kerosene and paraffin components. The Shukkoko field near Byoritsu, brought in 1904, is the oldest on Taiwan. The locations of the producing oil fields are shown on Figure 16. Of the oil fields the Kinsui, Koko, Chutung, Gyunikazuki and Kyusorin fields also produce natural gas in quantity. Crude oil production is quite low and insufficient for the island's needs. In 1936 petroleum production accounted for 1.1% by value of the total mineral production, the actual volume of crude oil produced being 45,440 U.S. barrels. Production fell in the post-war period to an annual average of 18,000 barrels.

There are two oil refineries on the island. The Byoritsu refinery built in 1904 to process the local crude oil has a capacity of 82,500 barrels a year. The Kaohsiung refinery was built just before the war for the Japanese Navy. Heavily damaged during the war, it has been rehabilitated.

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1 United States, Dept. of State. Energy Resources of the World. Washington, 1949.

2 Foreign Commerce Weekly, Vol. 38, No. 6: Feb. 6, 1950. p. 41.

3 Idem. p. 22.

4 Foreign Commerce Weekly, March 27, 1950.

The capacity of this refinery is between 4,000,000 and 5,000,000 barrels of crude oil a year. The crude oil was imported from the Persian Gulf oil fields. This imported oil was supplied after 1948 through the medium of E.C.A. of the United States. Taiwan's demands were met and the surplus exported to the mainland. The loss of the mainland markets in 1949 has resulted in cut-backs in production.

Gasoline is manufactured directly from the crude oil and natural gas at a number of the oil fields in gasoline absorption plants. Such plants are located at the Kinsui, Chutung, Shukkoko and Shinei fields. Carbon black, another product of the absorption process, is produced at the Kinsui, Chutung and Shinei plants.

Metals

Copper: Copper ores are found in the north-eastern part of the island (Figure 12). Practically the entire production is from one mine, the Kinkaseki, near Keelung. Proved ore reserves are 3,968,655 metric tons with probable ore reserves accounting for another 1,883,292 metric tons. The copper content of the ore averages 0.72%. Small amounts of copper ore are also produced at the nearby Taiyo (Zuiho) gold mine. During the Japanese period about 45,000 tons of ore were produced a year. The ore was concentrated in a reducing mill at the mine (capacity 3,500 tons of ore per day) and then sent to the Saganoseki copper refinery in Japan for refining.

Post-war production has been a fraction of that before 1945. In 1948 only 900 metric tons of copper were produced whereas the 1935-39 average was 6,700 metric tons. When the mainland refineries were closed to Taiwan ore an agreement was made with Japan to custom-smelt the copper ore at the Saganoseki refinery. In 1936 copper production accounted for only 1.6% by value of Taiwan's mineral production.

Gold: This precious metal which provided 43% by value of Taiwan's mineral production in 1936 is produced by the mining of ore bodies and by placer mining. Placer mining which originally was the source of all the island's gold production is no longer of any significance.

The Taiyo (Zuiho) mine is the largest gold producer, closely followed by the Kinkaseki copper mine (Figure 12). In both mines gold and silver bearing veins are found intruded in copper ore. The Kinkaseki mine has an estimated reserve of 5,016,545 metric tons of ore assaying 3.1 grams of gold and 9.5 grams of silver per ton of ore. Production in the post-war period declined to 12,200 troy ounces in 1948,[1] about 10% of the pre-war gold production.

Silver: Silver, produced as a by-product of gold and copper mining is not very important in terms of value in the mineral production of Taiwan (Table 1). During the period 1935-39 an average of 326,000 troy ounces of silver was produced each year.

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[1] Foreign Commerce Weekly, Dec. 12, 1949. p. 41.

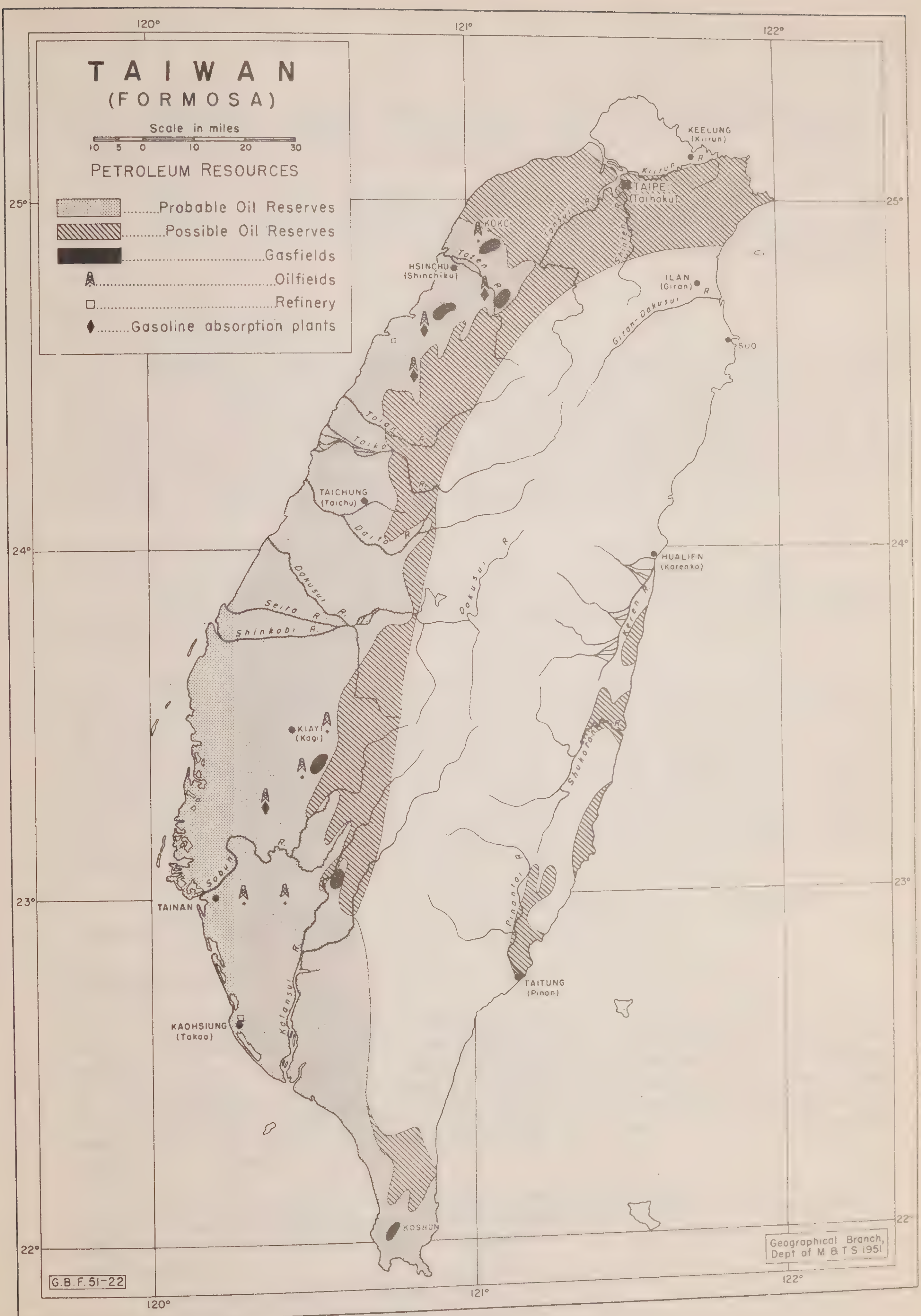
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
PETROLEUM RESOURCES
Probable Oil Reserves
Possible Oil Reserves
Gasfields
Oilfields
Refinery
Gasoline absorption plants
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kiirun)
TAIPEI (Taihoku)
KOKO
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kagi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
KOSHUN
Kiirun R.
Tansui R.
Shinten R.
Tozen R.
Giran-Dakusui R.
Taian R.
Taiko R.
Daiko R.
Dakusui R.
Seira R.
Shinkobi R.
Keren R.
Shukoran R.
Sobun R.
Pinanai R.
Katansui R.
Geographical Branch, Dept of M & T S 1951
G.B.F. 51-22

FIG. 16

Manganese: An estimated 300,000 metric tons of manganese ores, psilomelan and pyrolysite, are found in the mountains behind Suo (Figure 12). The manganese content of the ores is 35%.[1]

Iron: Very poor quality iron sands are found along the Kiirun and Tansui rivers. The estimated ore reserves are 5,388,000 tons.[1] Iron sands are also to be found near Suo along the Dainano-Hokun river just south of Ilan.

Non-metallic Minerals

Sulphur: Taiwan has large reserves of sulphur in the areas of volcanic rock, although no estimate has been made as to their extent. Pre-war demands were small hence the sulphur deposits were little developed by the Japanese. Lack of markets in the post-war period has kept production on a small scale. The centre of the sulphur mining is at Hokuto on the lower course of the Kiirun and Tansui rivers. The average annual production of 1,000 to 1,500 metric tons is all used locally.

Building Materials

The western third of the island is well endowed with sand, gravel and limestone for use in construction. Cement works at Suo, Kaohsiung and Hsinchu use local limestones.

Salt: Solar salt is produced by the evaporation of sea water in fields along the west coast. Salt fields covered an area of 4,584 acres in 1934-35 and were centred about the towns of Ampin, Hotei and Hokumon (Figure 12). Before 1895 the area covered was less than 500 acres. The Japanese made salt production a government monopoly, a policy which was extended by the Chinese after 1945. Production increased from about 130,000 tons in 1925 to over 200,000 tons after 1937. During the Japanese period about 120,000 tons were exported annually to Japan, the rest being used locally. In 1948 shipments of salt to Japan were again being made.

Mercury: During the war a small amount of mercury was mined at Hei-rin. In 1944, 0.1 metric tons were produced.

MANUFACTURING

Manufacturing was the second industry in Taiwan in respect to gross value of production in 1939, contributing 44% of the island's total production. About one-tenth of those gainfully employed on Taiwan are engaged in this industry. The processing of foodstuffs is the most important phase of the island's manufacturing, being 72.5% of the total in 1937.[2] Chemical manufacture and metal processing rank next in order (9.4% and 5.5% respectively).[2] (Tables 8 and 9).

Prior to 1945 the Japanese government had interests in 90% of the island's manufacturing plants and work-shops. After 1945, the government interests were taken over and even increased by the Chinese government syndicates.

1 Foreign Commerce Weekly, Dec. 12, 1949.

2 Mitchell, K. op. cit. p. 44.

A number of serious problems faced manufacturers after 1945 - problems which became even more acute following the separation of Taiwan from China proper in 1949. Primarily, raw materials, both mineral and vegetable, are inadequate for either wide variety or large-scale manufacturing. Secondly, production costs are very high because of absolete and deteriorated machinery, and inadequate plant maintenance. The third problem affecting manufacturing is a lack of markets for almost all exportable surpluses.

The labour supply on Taiwan is cheap and plentiful. During the Japanese period, Taiwan labour was paid half of what workers in similar industries in Japan were paid. Since 1945 inflation has added considerably to production costs through the medium of more expensive labour, but comparatively speaking labour is still cheap.

1. The Food Processing Industries:

In 1937, the food processing industries employed over 87,000 people and represented about 61% of the island's paid-up capital.[1]

Sugar: Sugar refining in 1937 accounted for 77% by value of the total foodstuffs manufactured.[1] In 1949, 35 modern sugar mills (Figure 17) were in operation as well as almost 100 primitive mills. Modern mills, numbering 51 in 1939, produced white sugar for the export market. Almost the entire production went to Japan where it supplied 90% of that country's needs. The Taiwan sugar industry was protected on the Japanese market by tariffs and subsidies. Sugar production varied as the demand for sugar on the Japanese market. In 1939, 1,419,000 metric tons were produced. Domestic consumption of white sugar on Taiwan was about 237,000 metric tons before 1949.[2] Dark brown sugar (Muscovade) is produced by the small primitive mills for local consumption. In 1939 by-product molasses amounted to 60,000,000 U.S. gallons. Candy and molasses constituted 4% by value of the island's manufacture in 1937.[1] On the whole the sugar industry is highly mechanized. Plantations and refineries are all interconnected by about 1,500 miles of narrow-gauge private railway. The location of the modern sugar refineries and the sugar nurseries is shown in Figure 17. The density of sugar refineries reflects the acreage planted to sugar cane.

Tea: Taiwan tea has been exported to the world markets since 1869. The tea factories in Taipei and its suburbs blend four types of tea - oolong, pouchong, black and green. Green tea makes up about 10% of the production and the others about 30% each. Tea which provided 5% by value of processed foodstuffs manufactured in 1937 was 1.4% of the total exports in 1939.[1] The oolong and black tea are shipped mainly to the United States. The pouchong or perfumed tea is shipped to Chinese in the Philippines and in Malaya. In 1946, the production of all types of tea amounted to 15,400 short tons.

Canned Pineapple: The first pineapple cannery in Taiwan was built in 1902. By 1930 Taiwan was the third largest producer of this cannery crop in the world, a position the island has since relinquished. In 1939

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[1] Mitchell, K. op. cit. p. 44.

[2] Funk, W.C. Sugar, Special Industry Analysis No. 22, Japanese Trade Studies. U.S., Foreign Economics Administration.

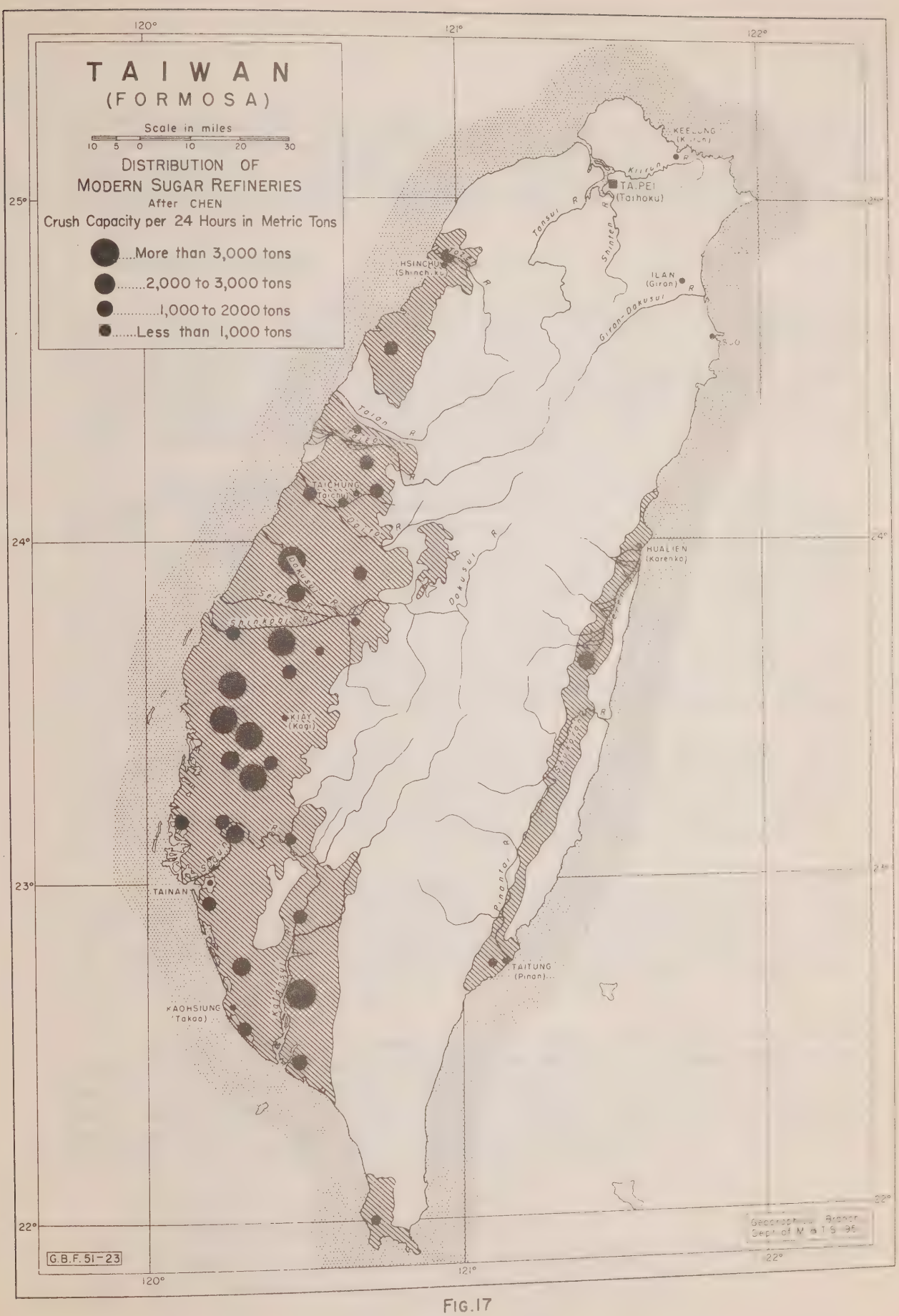
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
DISTRIBUTION OF
MODERN SUGAR REFINERIES
After CHEN
Crush Capacity per 24 Hours in Metric Tons
More than 3,000 tons
2,000 to 3,000 tons
1,000 to 2000 tons
Less than 1,000 tons
120°
121°
122°
25°
24°
23°
22°
KEELUNG
TAIPEI
(Taihoku)
HSINCHU
ILAN
(Giran)
HUALIEN
(Karenko)
TAICHUNG
KIAY
(Kagi)
TAINAN
KAOHSIUNG
(Takao)
TAITUNG
(Pinan)
Tansui R.
Shinten R.
Giran-Dakusui
Toyan R.
Dakusui R.
Shinkoshi R.
Pinantai R.
G.B.F. 51-23

FIG. 17

canned pineapple provided 2.2% of Taiwan's exports and was 5% by value of the total food manufacturers.[1] Almost the entire production was taken by Japan before 1945. After 1945, loss of markets, lack of fertilizers and more particularly a lack of operating funds have almost completely eliminated the pineapple canning industry.

2. Chemical Products:

Production of chemicals and chemical products, particularly fertilizers, increased greatly during the Second World War. In the post-war period production declined. The products manufactured on the island include vegetable oils and cakes, camphor, charcoal, paper, bleaching powder, calcium carbide, calcium cyanamide, potassium chloride, caustic soda, liquid chlorene, liquid bromine, ethyl alcohol, butyl alcohol, acetone, soap, hydrochloric acid and sulphuric acid.

Fertilizers: The domestic production of mineral fertilizers, so necessary to agriculture in sub-tropical regions, is far short of the island's total requirements. In 1948 production of calcium superphosphate was 28,300 metric tons and production of calcium cyanamide was only 10,000 metric tons. The plants located at Keelung, Kaohsiung and Lotung, make good use of the ample supply of cheap electric power. Keelung has two plants, one with a capacity of 60 metric tons of superphosphate and 40 metric tons of sulphuric acid per day and the other with a capacity of 20 tons of superphosphate per day. The capacity of the Kaohsiung plant is 60 tons of calcium carbide and 40 tons of cyanamide a day, while the Lotung plant near Suo has an installed daily capacity of 80 tons of carbide.

Alcohol: During the war a number of the sugar refineries were converted to the production of alcohol but almost all were completely bombed out. Butyl alcohol is made from dried sweet potatoes. The alcohol plant at Chai-yi (Kiayi) was restored to operation in 1949 and during that year used about 12,000 metric tons of dried sweet potatoes.[2]

Paper: There are seven paper mills on Taiwan with Kiayi and Rinnai being important pulp and paper centres. Chemical pulp is made from pulp wood. The paper mills also utilize pulp made from bamboo, (e.g., the plant at Rinnai) and bagasse, the cane waste from the sugar refining process. (For every 1,500,000 tons of sugar produced there is also produced about 2,000,000 tons of bagasse.[3])

Cement: The first cement plant on Taiwan began operations in 1917. Today there are three cement works on the island - at Kaohsiung, at Suo and at Chutung near Hsinchu. The Kaohsiung plant, constructed in 1917 has a daily capacity of 8,000 barrels of cement. The Suo plant has a daily capacity of 3,800 barrels and the Chutung plant, built in 1947, 2,000 barrels. The Chutung plant is connected by rail to the port of Hsinchu.

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[1] Mitchell, K. op. cit. p. 44.

[2] Foreign Commerce Weekly, Dec. 12, 1949.

[3] Gage, E. Industrial Development in Formosa. Economic Geography, July, 1950. p. 218.

The first two plants were badly damaged during the war but were completely restored to production by 1948. Local limestone and silica sand along with cheap coal and electricity have enabled surpluses to be produced. Cement was exported to Hong Kong and the Philippines. In 1948 the Philippine market was closed to Taiwan cement by a tariff barrier.

The Kaohsiung plant also manufactures cement and cinder blocks for building construction.

3. Textiles:

The manufacture of textiles was practically non-existent in Taiwan during the Japanese period. In part this was due to the lack of commercial fibre resources on the island and in part to the colonial economy imposed by Japan. In 1937, some 4,000 workers were employed in the textile industry, most of them in making jute bags.

In 1947 there were 20,000 cotton spindles in Taiwan, the majority of which moved to Taipei from Shanghai after 1945. By the end of 1948 another 50,000 spindles had been moved from Shanghai to cotton yarn and cloth factories in Taipei. The raw cotton requirement for this cotton industry is 1,000 bales per month, almost all of which has to be imported.

4. Metallurgy and Metal Working:

The island contains a large number of machine shops, repair shops and metal working plants. These look after the repair, maintenance and, to a certain extent, replacement of all types of machinery and equipment on the island. Small iron and steel working plants (foundries, blast furnaces, rolling mills, electric furnaces, etc.) are to be found in Kaohsiung, Taipei, Shichito, Hatto, Tainan, Okayama, Matsuyama, Hualien and Keelung.

Aluminum: Aluminum plants were built at Kaohsiung and Hualien during the second phase of the Japanese rule to take advantage of Taiwan's cheap electricity. Both plants were badly damaged during the war but the Kaohsiung plant whose original annual capacity was 20,000 metric tons, was restored to partial production in 1948 when 2,500 metric tons were produced.[1] The bauxite is imported from the island of Bintam, near Singapore. Production costs are high because of Japanese competition for the Bintam ore supply.

ELECTRIC POWER SUPPLY

The swift-flowing mountain streams and the heavy rainfall provide Taiwan with an hydro-electric power potential of 2,500,000 kilowatts. Prior to 1945 the installed electrical generating capacity on the island was 152,000 kilowatts. Thermal-electric power derived from coal supplied 20%, the balance being hydro-electric power. All the power stations but one (at Hualien) are located in the western half of the island. The western power plants are all connected by a grid.

During the war many of the power plants were seriously damaged during air raids. In 1949 the developed capacity was 130,000 kilowatts.[2] This reached 143,000 kilowatts in 1950.

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1 Foreign Commerce Weekly. Vol. 27, No. 5, Nov., 1949.

2 Foreign Commerce Weekly, Dec. 12, 1949.

The largest single hydro-electric power plant is located near the largest water reservoir on the island - the Sun-Moon Lake, at an elevation of 2,400 feet above sea level. The two lakes, located in a basin in the central mountains were linked when the construction of a dam raised the level of the water 120 feet.[1]

The good, hydro-electric power potential of the island was in part responsible for the Japanese establishing an electro-metallurgical and electro-chemical industry during the second phase of their control.

COMMUNICATIONS

The outstanding feature of the roads and railways of Taiwan is the influence exercised by physiography. The Central Mountains present an impenetrable barrier to communications between the east coast and the west coast. Only a few foot trails through the dangerous Malay tribal lands lead from the western foothills to the settlements in the Hualien-Taitung Trench. A precarious coastal road was built by the Japanese from Suo to Koshun to unite the east coast with the rest of the island.

The lowland areas are covered by a good network of roads and railways. The western plain is served by interurban standard-gauge railway lines, narrow-gauge lines beloning to the sugar syndicate, pusher-car tramways and well-built roads. The roads and rails weave through the complex pattern of paddy fields and irrigation canals. Both road and rail connect the western plain to the Plain of Ilan. The narrow Hualien-Taitung Trench is traversed by a railway line and a few stretches of good road. Both ends of this railway line are joined to the settled parts of the island by sections of the east coast road.

Railroads: (Figure 18) In all there are approximately 2,462 miles of railway line of all types on the island. Of the railway lines 1,990 miles are privately owned. This trackage is made up of the narrow gauge lines serving the sugar plantations and refineries and the tramways with their human powered hand-cars which penetrate the foothills. The remaining 472 miles of track are owned by the government. The main line from Keelung to Kaohsiung is 254 miles long. From Keelung, a line runs for 62 miles along the northeast coast, skirting the mountains, to the Plain of Ilan and on to Suo where it terminates. The southernmost point reached by rail on the western plain is Linpien, 39 winding miles from Kaohsiung. The Hualien-Taitung line (Figure 18) is 109 miles long.

Highways: Taiwan is traversed by 2,293 miles of main road, mostly built by the Japanese, and 8,524 miles of secondary roads. The western plain contains the greatest mileage. The east coast highway running from Suo to the Koshun Peninsula is an extremely narrow road cut into the shore-cliffs which rise out of the sea. It provides an alternative route, albeit a precarious one, to the railway connecting Hualien and Taitung.

The location of the major highways is shown on Figure 19. Bus services are operated between the larger urban centres.

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[1] Gage, E. op. cit. p. 217.

Air Transport: Before Taiwan was isolated from the Chinese mainland in 1948, a scheduled air service between Tainan and Amoy was in operation. At Amoy connections were made to Hong Kong and Shanghai. These flights were discontinued in 1949. In December of the same year Taipei became a stopover point on the scheduled flight from Tokyo to Manila. A tri-weekly flight from Taipei to Hualien shortens the time needed to travel from the western plain to the eastern part of the island.

Maritime Communications: Scheduled sailings to the mainland ports of the Fukien coast, Canton and Shanghai from Keelung and Kaohsiung were terminated during 1948. Despite the political differences between the mainland and the island trade is carried on, albeit clandestinely, by small junks.

Coastal shipping is one of the major means of communications between the western plain and the east coast settlements. Keelung, Kaohsiung, Suo, Hsinchu, Hualien and Taitung are the most important ports. Tansui, Tainan and Rokan (Rokko) were important ports in the early days of Taiwan. They are still important ports in the junk trade with the mainland and Hong Kong. (Figure 20)

Telephone and Telegraph: Telephone and telegraph lines follow the railway lines between the major cities and interconnect the sugar plantations and refineries. Radio-telephone service is maintained with Hong Kong and Tokyo.

POPULATION

The inhabitants of Taiwan numbered 7,026,883[1] in May 1949. In 1905 when the Japanese administration made the first census of the island the population was 2,405,008.

Ethnic Groupings

The population of Taiwan is formed by two distinct ethnic groups, the Chinese and the aboriginal inhabitants. The aboriginals number only about 150,000.

The Chinese form several distinct groups. These groups reached Taiwan at different periods in the island's history and because of minor cultural differences retained some individual characteristics. The Hakkas, who number approximately 1,000,000, form the first of these groups. They are descendants of refugees and exiles from northeastern Kwantung who reached the island before the 19th Century. On Taiwan they occupy the frontier of settlement next to the territory of the aboriginal tribes. The Hakka is an individualistic farmer and woodsman.

A second group is formed by the descendants of peasants who migrated to Taiwan from Fukien during the 18th and 19th Centuries. This group, numbering now between four and five million, forms the bulk of the agricultural population of the western plain. On the whole it is represented by a very conservative peasantry.

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[1] China Handbook, 1950. The Rockport Press, New York, 1950, p. 33.

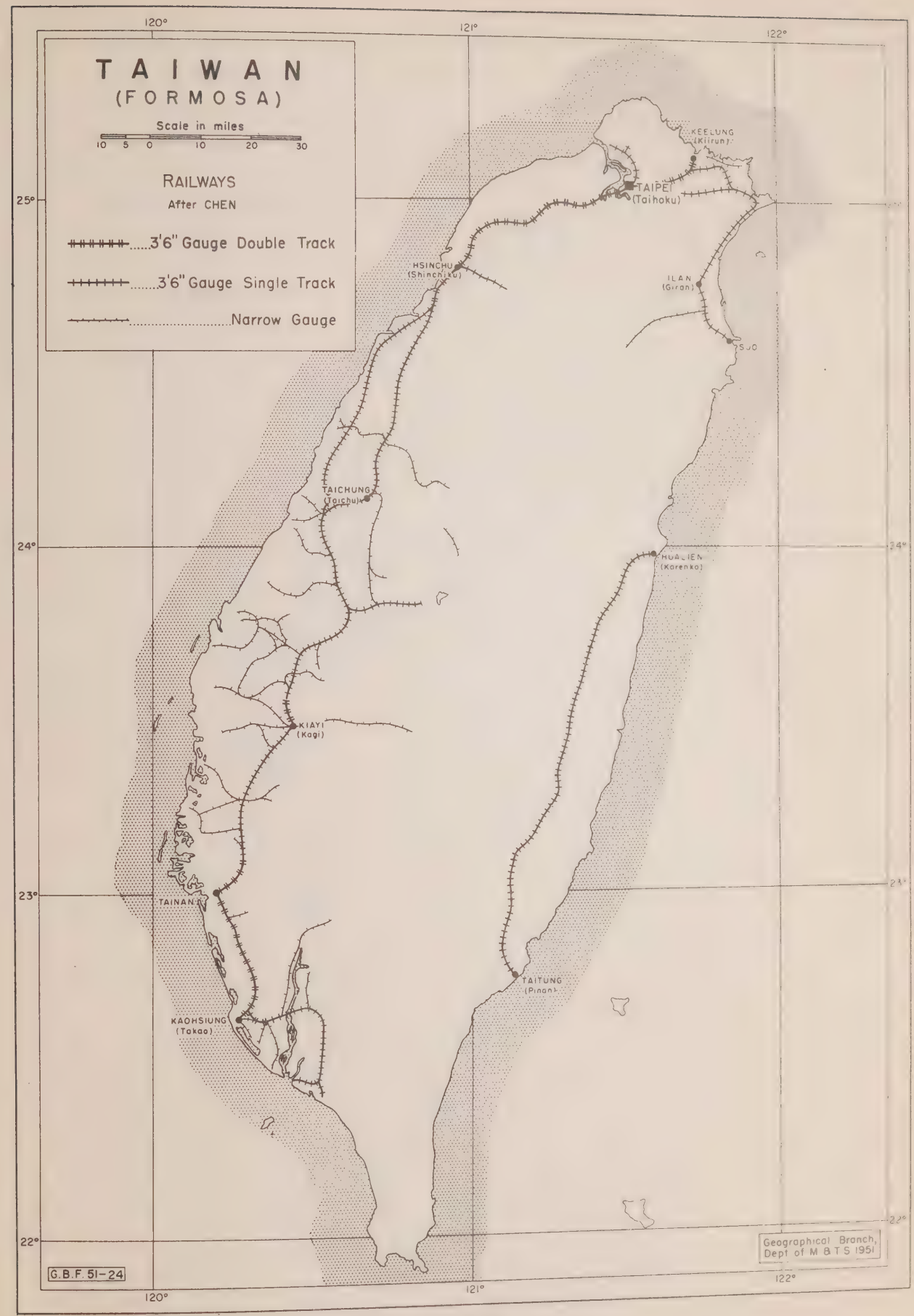
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
RAILWAYS
After CHEN
3'6" Gauge Double Track
3'6" Gauge Single Track
Narrow Gauge
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kiirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
SUO
TAICHUNG (Taichu)
HUALIEN (Karenko)
KIAYI (Kagi)
TAINAN
TAITUNG (Pinan)
KAOHSIUNG (Takao)
G.B.F. 51-24
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FIG. 18


TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
HIGHWAY TRANSPORT
Main Road
Branch Road
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
G.B.F. 51-25
Geographical Branch,
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FIG. 19


TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
AIRFIELDS AND SEAPORTS
Airfields
Major Ports
Minor Ports
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kirun)
TAIPEI
(Taihoku)
Kirun R
Tansui R
Shinten R
HSINCHU
(Shinchiku)
Toyen R
ILAN
(Giran)
Giran-Dakusui
SUO
Taian R
Taiko R
TAICHUNG
(Taichu)
Daito R
Dakusui R
Seira R
Shinkobi R
HUALIEN
(Karenko)
Karen R
KIAYI
(Kagi)
Shukorian R
Sobun R
TAINAN
Pinanlai R
TAITUNG
(Pinan)
Kaoansui R
KAOHSIUNG
(Takao)
G.B.F. 51-26
Geographical Branch,
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FIG. 20

The third group of Chinese is formed by the mainland Chinese who have come to Taiwan after 1945. Government administrators sent to the island in 1945 to take over control from the Japanese were soon followed by relatives, and in 1948-49 by refugees from the Communist armies. These post-war newcomers have increased the islands population by between 1,500,000 and 2,000,000. The majority of these people have taken up residence in the large cities.

The Aboriginal peoples have occupied the mountainous retreats of the island since the invasion of the Chinese agriculturalists. Physically and culturally they are representatives of the Malay peoples. There has been some mixing with the Chinese types along the zones of cultural contact - both physically and culturally. The more remote tribes still practice head-hunting, a prestige factor by which social status within the group is attained. Generally speaking the aboriginal peoples enjoy an economy of shifting agricultural and hunting. In addition to the Malay and Malay-Chinese physical types there are isolated instances of individuals with pygmy and negroid characteristics. Such people represent the Longkiu and pre-Longkiu strains which have survived in the isolate mountain retreats.

The Malay peoples of Taiwan are divided amongst seven major tribes. Although culturally and physically derived from the same stock the tribes can be differentiated on the basis of their relations with the Formosans. The "tame or subdued savages", comprising about two-thirds of the total number of aboriginals, have adopted some Chinese cultural traits. The "wild or untamed savages" maintain the primitive Malay culture in the more inaccessible mountains. The seven tribes, whose territories are shown on Figure 21, are as follows:-

Taiyal. Of the 152,350 aboriginals on Taiwan in 1936, 36,128 were members of the Taiyal tribe.[1] The Taiyals are amongst the fiercest Malays of the island and dwell in the rugged Central Mountains. Their villages are usually found at elevations ranging from 800 to 5,000 feet above sea level.

Bunum. The Bunums, who occupy the Central Mountains south of the Taiyals are also "untamed savages". In numbers they are a smaller tribe than the Taiyals, (17,910 in 1936).[1] The Bunum villages are found on the mountain slopes and in the valleys between 1,500 and 6,500 feet above sea level.

Saisett. This tribe is the smallest in numbers (1,486 in 1936)[2] and the most peaceable. Their tribal territory, in the Western Foothills region, is relatively small.

Tsuou. In 1936 the Tsuou people numbered 2,167.[2] They occupy villages in the river valleys cutting the western slopes of Mt. Morrison. The Tsuou villages are generally at an elevation of 2,500 feet above sea level.

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[1] The Foreign Affairs Association of Japan. The Japan Year Book, 1938-9. The Kenkyushu Press, Tokyo. p. 972.

[2] The Japan Year Book 1938-9, op. cit. p. 972.

Tsarisen and Paiwan. This tribal group which numbered 43,987 in 1936[1] occupies the southern part of the Central Mountains and the Southern Foothills as far south as Koshun. The villages are located at elevations up to 4,000 feet above sea level.

Piyuma (Yami). The Piyumas are "tame savages" occupying the plain and mountains around Taitung. They formed the second smallest tribe in 1936, with a total of 1,713[1] members.

Ami. This is the most numerous Malay tribe on Taiwan, (48,898 in 1936).[1] Almost all the Ami tribesmen practice a primitive form of agriculture. The tribal lands include the Coastal Mountains and parts of the Taitung-Hualien Trench.

Demography

In the 45 year period between 1905 and 1950 the population of Taiwan has tripled. In 1905, the Japanese census reported a total of 2,405,008 people on the island. The population grew to 3,655,000 in 1920, 5,212,426 in 1935 and reached a total of 7,026,883 in 1949. The aboriginal numbers remained more or less stable during this period at from 110,000 to 150,000. Because of the inaccessible location as well as the hostility of the aboriginal tribes, population statistics for the tribes are at best estimates. In 1905 there were 60,000 Japanese on the island - administrators and their families, merchants and plantation managers. By 1920 the number of Japanese had increased to 167,000, by 1938 to 309,000 and by 1945 to 480,000. At the end of 1945 all the Japanese were repatriated to Japan Proper. The Japanese officials and managers were immediately replaced by mainland Chinese. During the period of 1947-49 there was an influx of about 1,500,000 refugees from the mainland.

The bulk of the population growth therefore, except in the post-war period, was due to the natural increase of the Formosans. The average annual birth rate for the island during the period 1920-24, was 41 per 1,000 and the death rate 26 per 1,000.[2] During the period 1933-37 the average annual birth rate increased to 46 per 1,000 of population and the death rate lowered to 21 per 1,000. Thus the average annual net increase during this period rose to 25 per 1,000.[3]

The overall population density of the island increased accordingly. In 1920 it was 264 per square mile, in 1935 about 377 per square mile and in 1949 reached 508 persons per square mile. These figures, however, do not present the true picture of population distribution on Taiwan. Since two-thirds of the island consists of densely wooded, rugged mountains over 90% of the population occupies the remaining lowland third. The population density on these lowlands is very high. In 1920 it was approximately

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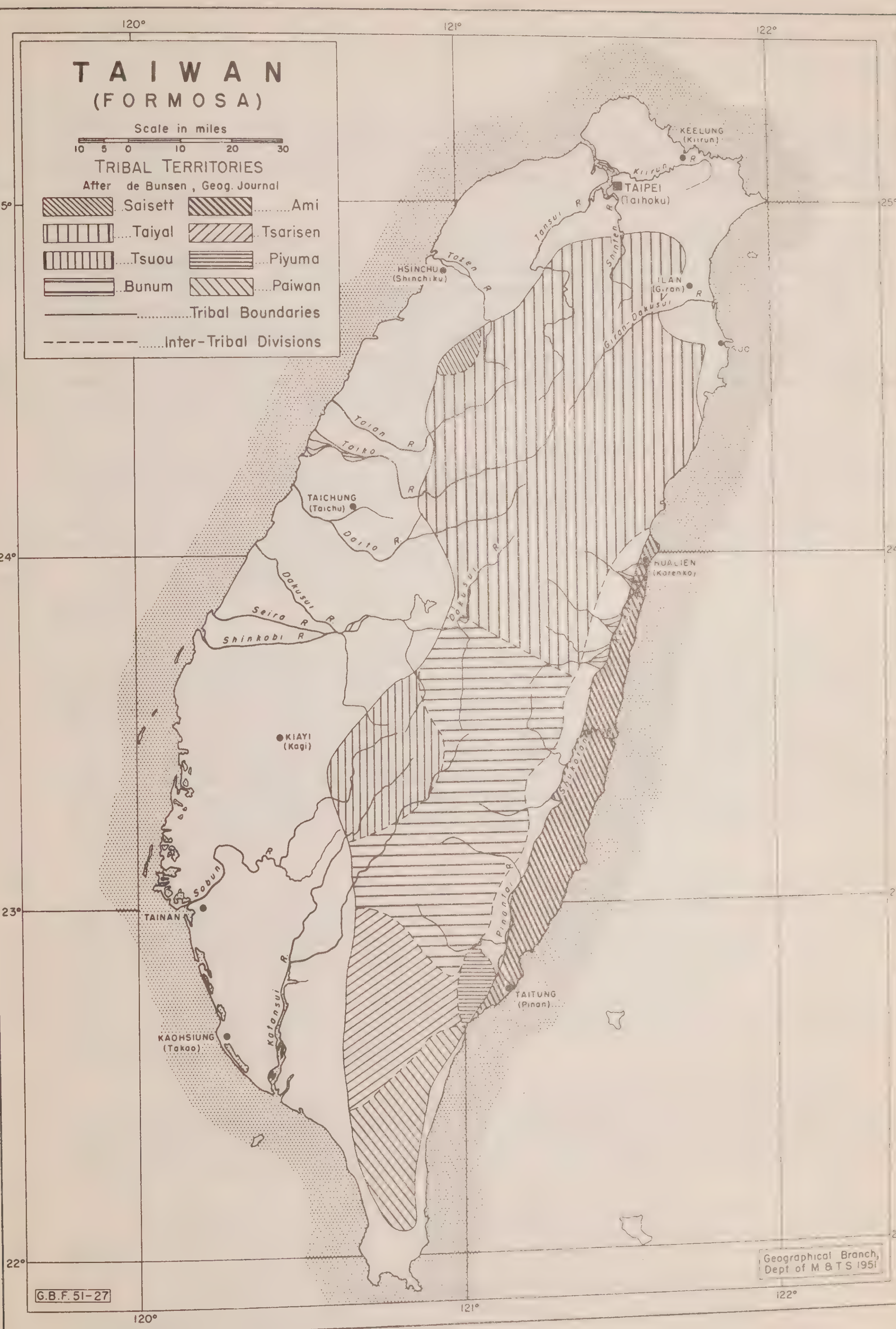
[1] The Japan Year Book 1938-9, op. cit. p. 972.

[2] U.N., Dept. of Economic Affairs. Economic Survey of Asia and the Far East, 1948. Lake Success. 1949.

[3] Idem.



TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
TRIBAL TERRITORIES
After de Bunsen, Geog. Journal
Saisett
Ami
Taiyal
Tsarisen
Tsuou
Piyuma
Bunum
Paiwan
Tribal Boundaries
Inter-Tribal Divisions
120°
121°
122°
25°
24°
23°
22°
KEELUNG (Kiirun)
TAIPEI (Taihoku)
HSINCHU (Shinchiku)
ILAN (Giran)
HUALIEN (Karenko)
TAICHUNG (Taichu)
KIAYI (Kagi)
TAINAN
KAOHSIUNG (Takao)
TAITUNG (Pinan)
Kiirun R
Tansui R
Shinten R
Tozen R
Giran-Dakusui R
Taian R
Taiko R
Daito R
Dakusui R
Seira R
Shinkobi R
Sobun R
Kotansui R
Pinantai R
G.B.F. 51-27
Geographical Branch, Dept of M & T S 1951

FIG. 21

816 per square mile; in 1935 it was about 1,015 per square mile and in 1949 it was more than 1,366 per square mile - a population density typical of the lowland areas of monsoon Asia. Figure 22 shows the density of population in 1947.

The majority of the Formosans are agriculturalists. In 1936, 65.6% of the population was rural and 34.4% lived in cities of more than 10,000 people.[1] No estimate was made of how many of the urban population were engaged in agriculture but over 75% of the gainfully employed on the island are engaged in agriculture. The large rural population lives almost entirely in agricultural villages. In 1939 about 9% of the gainfully employed were in manufacturing and mining. (The term "manufacturing" also includes household and handicraft industries.)[2]

Taiwan then, it is evident, is occupied by a predominantly Chinese population most of whom are natives of the island. The people are primarily small farmers and over 90% of the population lives in the fertile, very densely populated lowlands. The mountains - densely forested and extremely rugged - are occupied by the Malay tribesmen and a pioneer fringe of farming woodsmen.

Major Cities

Although three-quarters of Taiwan's people before 1946 were engaged in agriculture a large part of the population lived in urban settlements. In 1936, 34.4% of the population dwelt in cities with over 10,000 people. This proportion of city dwellers has increased substantially with the flood of refugees from the mainland between 1947 and 1949. The agricultural population lives in small villages amidst the paddy fields - villages typical of the crowded monsoon rice-growing regions of southeast Asia. Figure 23 shows the distribution of cities and rural towns with over 5,000 inhabitants in 1947.

Towns and cities pipe their water supply from the mountain streams and the water is distributed almost entirely through public taps. The rural communities rely on deep wells for their water supply. Most towns have open sewers and drains. The danger of epidemic is thus quite acute.

Despite the fact that almost all the people on Taiwan live in cities, towns and villages only a few urban centres are of major importance to the island's economy.

Taipei (Taiboku) is the largest city and seat of the provincial government of Taiwan. It is also the provisional capital of the Nationalist Government of China. Taipei was also the capital city of Taiwan during the Japanese period. Its population has grown rapidly, especially in the

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[1] Pelzer, K.J. Population and Land Utilization, Part I of Economic Survey of the Pacific Area. Institute of Pacific Relations, New York, 1941. p. 13.

[2] Mitchell, K. Japan's Industrial Strength. Institute of Pacific Relations, New York, 1947. p. 42.

period 1946-1949. In 1927 Taipei had 211,000 people,[1] in 1940 - 326,000[2] and in May 1949 - 439,793.[3] In addition to being the island's administrative centre Taipei is also a manufacturing and educational centre. Machine shops, tea factories and other food processing plants as well as textile mills are the major part of the city's industry. The National Taiwan University and the Provincial colleges of Agriculture, Engineering and Teaching are all located here. Taipei is also the financial centre for the island. Two ports serve the capital, the old river port of Tansui at the mouth of the Tansui River, which is no longer of importance, and the modern industrial port of Keelung.

Tainan, the second city of Taiwan, was a pre-Japanese administrative centre. Before the day of the large steamer it was an important port in the junk trade with the mainland. It was the site of a Dutch fort in 1623. Today it is primarily a marketing centre but it does have an iron working industry. It is also the administrative centre for Tainan District. In 1940 the population was 142,133;[2] in 1949 it was well over 200,000.[3]

Kaohsiung (Takao), is the most important manufacturing centre in Taiwan as well as being a major port and the third largest city. In 1936 it had a population of 94,017[4], in 1940 - 152,265[2] and in May 1949 it contained over 211,000 people.[3] The Japanese built a large naval base and oil refinery here. The city is the southern terminus of the main line of the island's rail system and the chief market centre for southern Taiwan. Kaohsiung is one of the oldest settlements on the island being founded by the Ming refugees in the 17th Century. Today it is the administrative centre for the Kaohsiung District.

It's industries includes cement works, an aluminium smelter and refinery, a magnesium smelter, a fertilizer plant, textiles, iron and steel fabrication and chemicals and food processing plants. It is the centre of the sugar trade, which makes it the second port of Taiwan.

Keelung (Kiirun), is the largest port on Taiwan. Its 1949 population of 123,000[3] made it the seventh city in size on Taiwan but it ranks in importance next to Taipei and Kaohsiung. It is an important communication centre, being the northern terminus of the island's main railway line. It is also the terminus of the highway and the railway line which lead to the Plain of Ilan and the east coast settlements. The city is only 14 miles from Taipei and acts as the capital's port. An important industrial centre, it has iron and steel fabrication plants and fertilizer plants.

Taichung (Taichu), in the centre of the rich agricultural western plain is the administrative centre for the district having the same name. It is an important marketing centre for rice and sugar. Taichung is one of Taiwan's larger centres having a population of 74,839 in 1936.[1]

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[1] The Japan Year Book 1938-39. op. cit.

[2] Encyclopaedia Britannica Year Book, 1950.

[3] China Handbook, 1950. op. cit. p. 33.

[4] The Japan Year Book. op. cit.

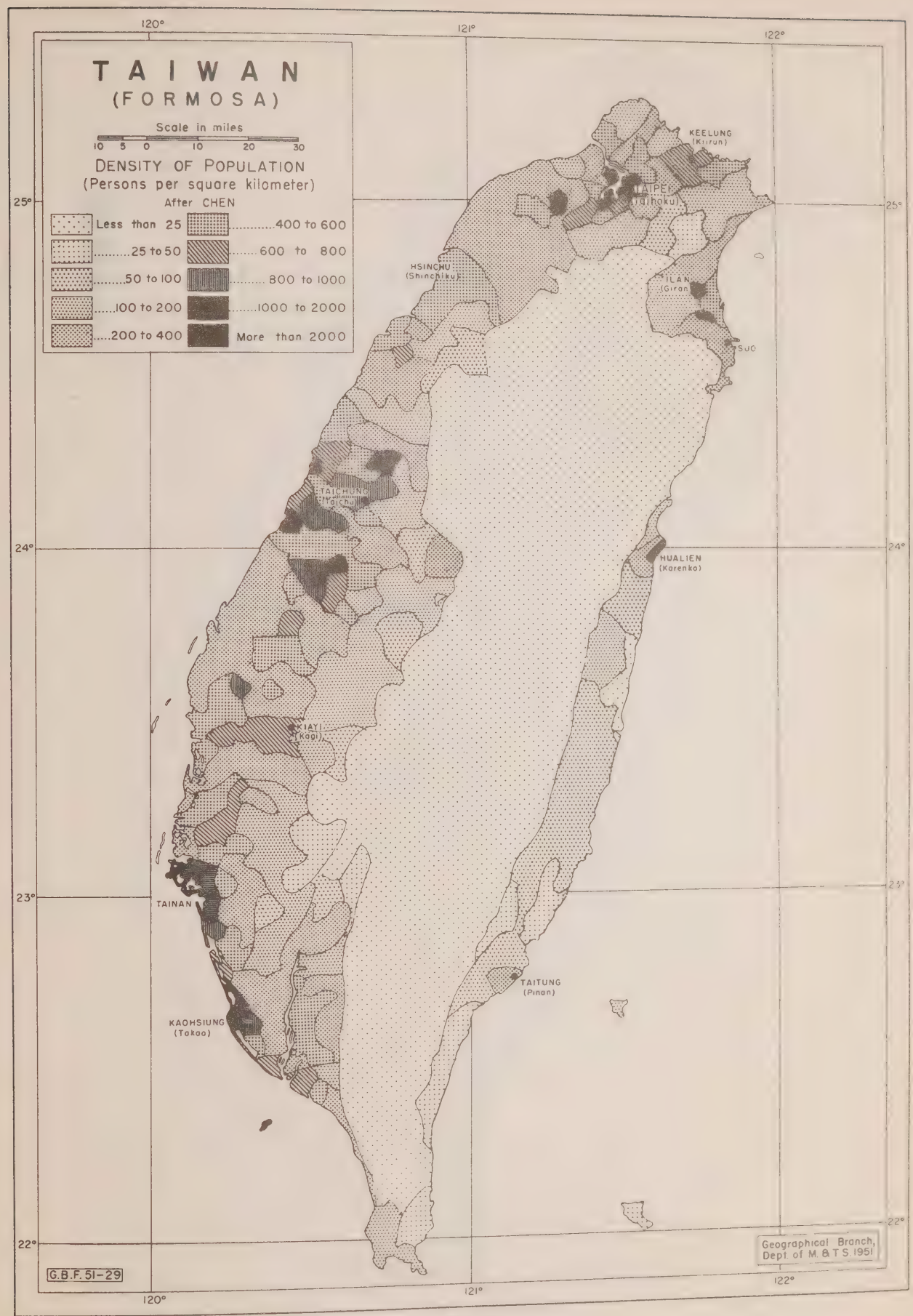
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
DENSITY OF POPULATION
(Persons per square kilometer)
After CHEN
Less than 25
25 to 50
50 to 100
100 to 200
200 to 400
400 to 600
600 to 800
800 to 1000
1000 to 2000
More than 2000
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kiirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
CHIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
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FIG. 22

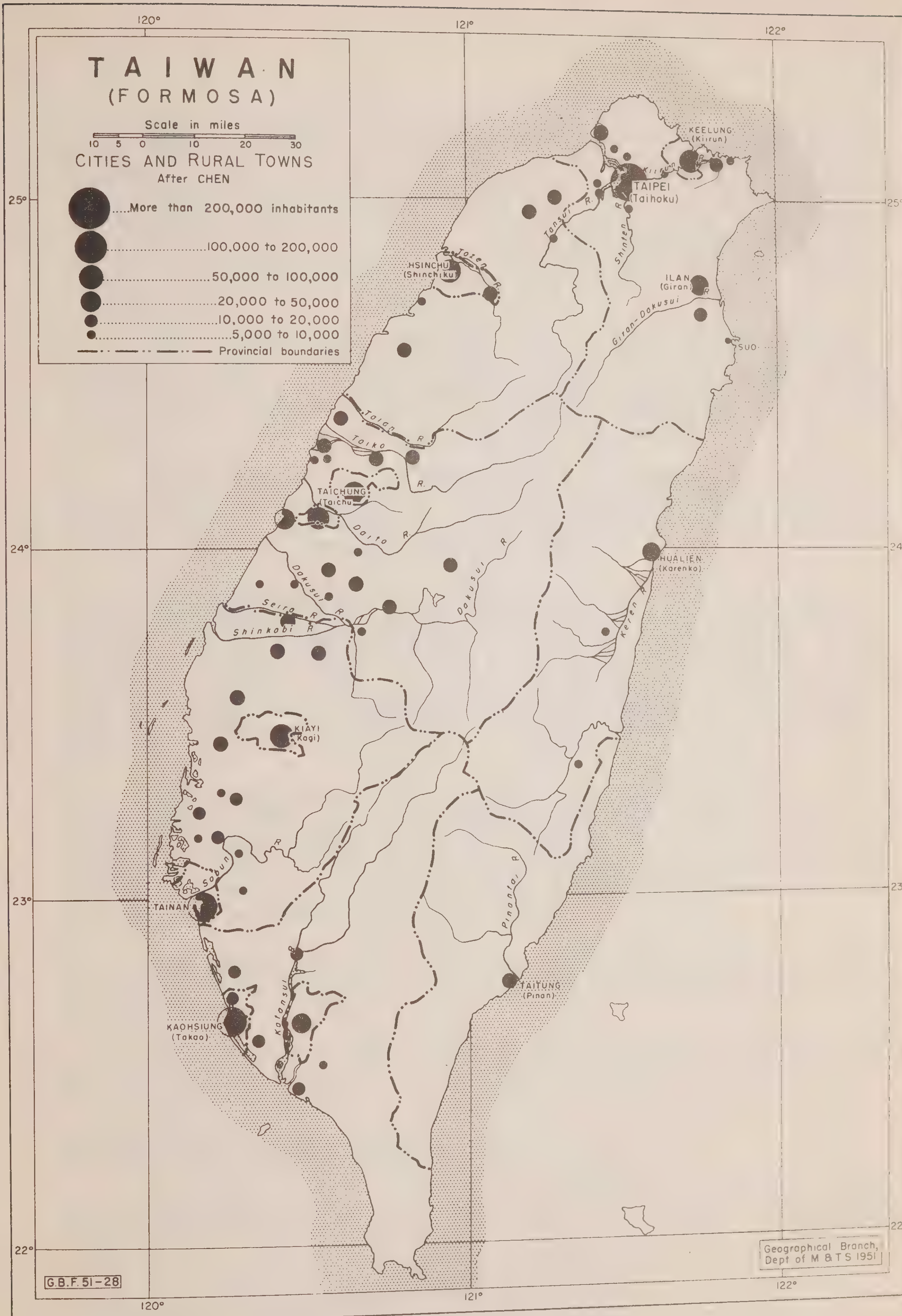
TAIWAN
(FORMOSA)
Scale in miles
10 5 0 10 20 30
CITIES AND RURAL TOWNS
After CHEN
More than 200,000 inhabitants
100,000 to 200,000
50,000 to 100,000
20,000 to 50,000
10,000 to 20,000
5,000 to 10,000
Provincial boundaries
120°
121°
122°
25°
24°
23°
22°
KEELUNG
(Kiirun)
TAIPEI
(Taihoku)
HSINCHU
(Shinchiku)
ILAN
(Giran)
SUO
TAICHUNG
(Taichu)
HUALIEN
(Karenko)
KIAYI
(Kagi)
TAINAN
TAITUNG
(Pinan)
KAOHSIUNG
(Takao)
Tansui R.
Shinten R.
Kiirun R.
Tozen R.
Giran-Dakusui
Taian R.
Taiko R.
Daito R.
Dakusui R.
Seira R.
Shinkobi R.
Keren R.
Sobun R.
Pinantai R.
Katansui
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FIG. 23

Hualien (Karenko), lies at the northern end of the Hualien-Taitung Trench about 1½ miles north of the mouth of the Keren River. It is the northern terminus of the rail line which runs south to Taitung. A nearby hydro-electric power plant provided the basis for a wartime electro-metallurgical industry Hualien contained a small aluminium smelter and a small nickel smelter. It's industry also includes iron and steel fabrication. The city is the administrative centre for the Hualien District. In 1935 Hualien's population was 17,042.[1]

Suo, at the southern end of the Plain of Ilan, has the best harbour on the east coast. It is the terminus of a rail line from Keelung and the northern end of the east coast road. Lumbering, manganese mining and agriculture are all carried on in the area about the city making it a good market centre. In 1935 its population was about 16,000.[1]

Taitung (Pinan), at the southern end of the Taitung-Hualien Trench is the administrative centre for the Taitung District. It is a road and rail terminus and the market centre for the southern part of the trench. A small harbour, it had 14,634 people in 1935.[1]

Hsinchu (Shinchiku), on the western coast is the oldest Chinese settlement in northern Taiwan and the administrative centre for the Hsinchu District. It is an important communications and marketing centre. Nearby are the oil centres of Koko, Chutung (Chikuto), Kinsui and Shukkoko. Coal is also mined nearby. The oil, coal, local plantation crops and fertilizer from the Chutung plant make Hsinchu an important commercial centre and port. Its population has increased far beyond the 1936 total of 55,015 people.[2]

Kiayi (Kagi), lies where the plain and foothills meet west of the Arisan forest. The city lies on the main line from Keelung to Kaohsiung and is an important lumbering town and marketing centre. Paper mills and sawmills are located here. A railway line extends 41 miles from Kiayi to the timber camps on Mt. Arisan. The city is one of the largest on the island having a population of 92,428 in 1940.[3]

Pingtung (Heito), is an important communications centre and market town in Kaohsiung District. In the midst of a good agricultural area it had 46,398 people in 1936.[2]

Changhua (Shoka), lies about half-way between the city of Taichung and the junk port of Rokan. It is a road and rail centre as well as being a marketing town. In 1936 it had a population of 54,304 people.[2]

TAIWAN'S HISTORICAL RELATIONSHIPS IN THE FAR EAST

Culturally as well as physically each place on the earth's surface has a definite position in relation to its neighbouring areas. Throughout man's history islands have tended to be places of refuge - of a people,

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1 The Japan Year Book 1938-39. op. cit.

2 Japan Year Book 1938-39. op. cit. p. 33.

3 Encyclopaedia Britannica Year Book. 1950.

of an idea, of a way of life - especially if the island happened to be relatively small and somewhat away from the main avenues of human endeavour. Mountainous regions have played a similar traditional role in history. Taiwan is a relatively small, very mountainous island lying 80 miles off the eastern coast of the Asiatic land mass, removed from the mainstream of continental migration.

For centuries it fulfilled its traditional role as a place of refuge for peoples and ideas from Southeast and Far East Asia - the head-hunting Malay tribesmen, the Hakkas and the remnants of the Ming dynasty have indicated this. Increased ease of communications have brought each place closer to its neighbours. What was once a refuge now becomes an outpost of advance - of attack - or else it becomes a bastion of defense - of retreat. The relationships of Taiwan to the rest of Eastern Asia have followed this pattern - refuge, retreat and advance.

Early in its history the island presented an almost insurmountable barrier to penetration by man. Its shores were difficult to breach - the east coast was precipitous with shore-cliffs rising thousands of feet out of the water; its west coast was one wide shoal, with beaches of swampy forests. For a long period of time Taiwan was the home of the Malay tribesmen, its forest-clad mountains and dangerous shores a defense against a militant people. During the 15th and 16th Centuries pirates took up residence in what good harbours there were, making the island their base for attacks on shipping in the China Seas.

In 1661 supporters of the Ming dynasty fled the conquering Manchu armies and sought refuge on Taiwan. The island became for them not only a place of refuge but a bastion of defense of the Ming traditions, for they continued to wage war with the Manchus. Under Koxinga the island fulfilled its role as an outpost of advance as the Ming supporters raided the mainland coast. Following the death of Koxinga the raids stopped and the Ming partisans again were on the defensive. In 1682 they acknowledged the suzerainity of the Manchus and Taiwan once again assumed its "refuge" character.

For the next two centuries the island became a home for exiles and landless men from southern China, the majority of them independent minded Hakkas. Until the Japanese gained control of the island the "refuge" nature of the island had two phases. On the western lowlands and foothills dwelt the Chinese, refugees and exiles from the mainland. In the mountains dwelt the head-hunting Malay tribesmen, representatives of a primitive culture.

With the coming of the Japanese the function or characteristic role of the island changed again. The rugged mountains still remained a place of refuge for no matter how hard they tried the Japanese, like the Chinese before them, could never completely conquer the Malay tribesmen. Under the Japanese, Taiwan became an outpost of advance - a base for expansion into south China and Southeast Asia. Modern techniques of communications and transport have tended to emphasize Taiwan's position (Figure 1). Naval bases built at Kaohsiung and Keelung and the numerous airfields constructed on the western plain (Figure 20) were the jumping off places from which the Japanese launched their attacks on the Philippines and the Dutch Indies in 1941. During the Second World War Taiwan was the major supply base and marshalling area for the Japanese armies in Southeast Asia.

Japanese surrender and departure in 1945 signalled the loss of Taiwan's role as an outpost of advance. In 1947 the island again renewed its traditional function as a place of refuge as Nationalist Chinese from the mainland fled before the advancing Communist armies. Two years later the Chinese Nationalist government left the mainland to set up its provisional capital at Taipei and Taiwan again became an outpost of retreat. The similarity between the position of the Nationalists under Chiang-Kai-Shek and the Ming partisans under Koxinga, relative to the control of all China is self-evident.

Thus it can be seen that the characteristic role of Taiwan has changed with history. Modern techniques and world politics have re-emphasized the island's three-fold character - refuge, bastion of retreat and outpost of advance.

Taiwan's economic relationships can be generalized for simplicity's sake into two types - the passive and the active. When an area is economically passive, it is not taking part in international trade to any extent, that is, the economy of the area is primarily the result of only internal factors. On the other hand when an area is economically active its economic development is subject to external demands and the general status of the world's economy as well as to its own internal demands.

Before 1895, Taiwan was economically passive. The little tea and camphor which were exported had small effect on the way of life of the island's population, or on the factors of transportation and communications. Under the Japanese the island became economically active. The patterns of land use were changed; a different stress was applied to the development of all resources; transportation and communications facilities were expanded and the manner of living of many of the inhabitants was altered somewhat - all in response to the desires of the Japanese to integrate Taiwan's resources and development with the Japanese idea of a self-sufficient Empire. Taiwan, in short, was developed economically as a colony, the pattern of development varying as Japan's economic relationship with the rest of the world. The colonial economy developed by the Japanese was maintained but re-oriented by the Chinese Nationalist government from 1945 to 1948, in that the economic patterns of Taiwan were then integrated with the demands of the Chinese mainland.

Although the island's economics were affected by the world situation its trade was almost entirely unilateral. From 1895 to 1948 trade, both export and import, was almost exclusively with the nation whose demands controlled its economic development. In 1949 the Chinese political situation forced Taiwan to abandon its colonial status and fend for itself on world markets. For Taiwan this created difficulties yet to be surmounted.

SUMMARY

It can be seen, therefore, that the geography of Taiwan represents a balance between economic and social factors on the one hand and physical factors on the other. The island is endowed with limited flat land suitable for raising its staple crop and yet climatic conditions, and the exploitation technique of the island's people are such that optimum land use is achieved. Taiwan has spent much of its existence with the political framework of one of its two larger neighbours.

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APPENDIX A

STATISTICAL TABLES

TABLE NO. 1

FORMOSAN EXPORTS (Value in Million Yen)[1]

	1930	% of Total Value (95.4)	1937	% of Total Value (97.3)
Exports to Japan				
Sugar	141.9	68.2	189.0	53.0
Rice	38.7	18.5	126.2	35.2
Bananas	8.4	4.0	11.7	3.3
Canned Pineapple	3.5	1.7	7.6	2.2
Alcohol	2.6	1.2	7.4	2.1
Camphor & Camphor Oil	3.7	1.8	5.2	1.5
	1930	% of Total Value (4.6)	1937	% of Total Value (2.7)
Exports to Foreign Countries				
Tea	8.4	4.0	5.0	1.4
Sugar	0.1	0.1	2.6	0.8
Camphor	1.1	0.5	1.9	0.5
TOTAL	208.4	100	356.6	100

[1] Schumpter, E.B. ed. The Industrialization of Japan and Manchukuo, 1930-1940. The Macmillan Co. Ltd., New York, 1940. p. 295.

TABLE NO. 2

GROSS VALUE OF PRODUCTION[1]
(In Million Yen and as a Percent of the Total)

	1929		1933		1935	
	Yen	%	Yen	%	Yen	%
Agriculture	301.9	50.4	237.9	48.6	361.0	53.0
Fishing	21.0	3.5	15.9	3.3	19.4	2.9
Forestry	13.9	2.3	1.5	2.2	12.7	1.9
Manufacturing	246.8	41.3	209.6	42.8	264.9	38.0
Mining	14.8	2.5	15.2	3.1	22.8	3.3
TOTAL	598.4	100	489.1	100	680.8	100

	1939		1941	
	Yen	%	Yen	%
Agriculture	403.0	47.2	201.3	55.5
Fishing	21.4	2.5	9.6	2.6
Forestry	16.7	2.0	10.7	3.0
Manufacturing	374.9	44.0	130.9	36.1
Mining	36.2	4.3	10.3	2.8
TOTAL	852.0	100	362.8	100

[1] Mitchell, K. Japan's Industrial Strength Institute of Pacific Relations, New York, 1942. p. 43.

TABLE NO. 3

LAND UNDER CULTIVATION IN TAIWAN, BY PROVINCES, 1939 [1]

Province	Irrigated Land				Dry Farms	Grand Total
	Double Acreage	1st Crop Acreage	2nd Crop Acreage	Total		
	1,000 Acres	1,000 Acres	1,000 Acres	1,000 Acres	1,000 Acres	1,000 Acres
Taipei	131	5	5	141	89	230
Hsinchu	210	5	(2)	215	151	366
Taichung	253	1	11	265	160	425
Tainan	55	8	400	463	191	654
Kaohsiung	109	5	67	181	139	320
Taitung	16	2	(2)	18	24	42
Hualien	25	2	--	27	42	69
TOTAL	799	28	483	1,310	796	2,106

[1] Moyer, R.T. -- op. cit. p. 4.

[2] Less than 500 acres.

TABLE NO. 4

ACREAGE AND PRODUCTION OF PRINCIPAL CROPS IN TAIWAN,[1] AVERAGE 1931-35, ANNUAL 1939

CROP	Average 1931-35 Acreage Planted 1,000 Acres	Average 1931-35 Production 1,000 Short Tons	Average 1939 Acreage Planted 1,000 Acres	Average 1939 Production 1,000 Short Tons
Cereals:				
Paddy rice (2)	1,566	1,327	1,488	1,443
Upland rice (2)	103	59	59	32
Total rice (2)	1,669	1,386	1,547	1,475
Wheat	2	1	12	6
Barley	1	1	3	1
Proso millets	9	1	8	1
Foxtail millets	5	1	5	1
Corn	4	2	4	2
Legumes:				
Soybeans	19	5	13	4
Other beans & peas	27	6	24	5
Peanuts	73	30	72	31
Roots and tubers:				
Sweet potatoes	333	1,649	312	1,410
Radishes (Daikon)	14	80	18	80
Taros	(3)	(3)	4	15
Cassava	(3)	(3)	14	98
Other vegetables	(3)	(3)	75	326
Fruits:				
Citrus	(3)	33	12	39
Bananas	(3)	193	48	201
Pineapples	(3)	(4) 89	26	(4)146
Longan	(3)	8	6	6
Industrial crops:				
Sugar cane	244	7,341	401	14,134
Jute	10	8	57	26
Ramie	4	1	5	1
Sesame	9	1	8	1
Tobacco	2	2	5	4
Cotton	(3)	(3)	8	1
Castor beans	(3)	(3)	14	2
Sisal hemp	(3)	(3)	3	1
Tea	108	11	111	15

[1] Moyer, R.T. op. cit. p. 6.

[2] In terms of brown rice

[3] Data not reported

[4] Thousand pineapples

TABLE NO. 5

REPORTED ACREAGE OF THE PRINCIPAL FIELD CROPS OF TAIWAN, BY PROVINCES, 1939 [1]

Province	Rice 1,000 Acres	Sugar Cane 1,000 Acres	Sweet Potatoes 1,000 Acres	Tea 1,000 Acres	Peanuts 1,000 Acres	Soy-Beans 1,000 Acres	Other Beans 1,000 Acres	Wheat 1,000 Acres
Taipei	239	9	29	48	2	(2)	(2)	(2)
Hsinchu	345	29	42	61	7	—	(2)	(2)
Taichung	377	90	45	2	8	3	2	11
Tainan	303	184	134	(2)	33	1	18	(2)
Kaohsiung	209	66	49	(2)	7	8	3	—
Taitung	31	6	3	—	2	(2)	(2)	—
Hualien	43	17	4	(2)	4	1	(2)	(2)
TOTAL	1,547	401	306	111	63	13	24	12

[1] Moyer, R.T. op. cit. p. 7.

[2] Less than 500 acres.

TABLE NO. 6

REPORTED ACREAGE OF PRINCIPAL FRUITS
IN TAIWAN, BY PROVINCES, 1939 [1]

Province	Bananas Acres	Pine-apples Acres	Total Citrus Acres	Mangoes Acres	Plums Acres	Persimmons Acres
Taipei	436	229	3,652	7	257	117
Hsinchu	1,024	230	4,147	10	295	429
Taichung	29,670	14,991	1,975	77	1,460	139
Tainan	5,838	3,708	1,350	1,067	209	307
Kaohsiung	9,953	6,435	348	261	17	--
Taitung	992	29	108	12	10	14
Hualien	290	55	213	2	36	22
TOTAL	48,203	25,677	11,793	1,436	2,284	1,028

[1] Moyer, R.T. op. cit. p. 10.

TABLE NO. 7

MINERAL PRODUCTION OF TAIWAN, 1939 [1]

Article	Value in 1,000 Yen	% of Total Value
Gold and Gold Ore	12,343	43.0
Silver	17	0.1
Copper	470	1.6
Coal	11,365	39.6
Sulphur	87	0.3
Petroleum	312	1.1
Natural Gasoline	456	1.6
Carbon Black	282	1.0
Others	3,384	11.7
TOTAL	28,727	100.0

[1] Mitchell, K. Japan's Industrial Strength. Institute of Pacific Relations, New York. 1942. p. 47.

TABLE NO. 8

MANUFACTURE, PRODUCTION BY INDUSTRIAL DIVISIONS [1]
(Gross Value in Million Yen and as a Percent of the Total)

	1929		1931	
	Yen	%	Yen	%
Textiles	3.0	1.1	2.1	1.0
Metals	5.2	2.0	4.9	2.4
Machinery	5.3	2.0	5.1	2.5
Ceramics	9.4	3.5	6.8	3.3
Chemicals	23.1	8.8	13.3	6.5
Lumber	8.8	3.4	6.5	3.2
Printing	3.6	1.4	3.3	1.6
Foodstuffs	190.1	72.1	152.4	74.3
Others	15.3	5.7	10.6	5.2
TOTAL	263.8	100	205.0	100

	1935		1937	
	Yen	%	Yen	%
Textiles	3.6	1.2	5.0	1.4
Metals	8.8	2.9	12.0	3.3
Machinery	6.7	2.3	8.0	2.2
Ceramics	8.8	2.9	8.8	2.5
Chemicals	27.2	9.3	33.7	9.4
Lumber	9.3	3.2	5.5	1.5
Printing	4.4	1.5	5.0	1.4
Foodstuffs	212.6	72.6	261.3	72.5
Others	12.1	4.1	20.8	5.8
TOTAL	293.5	100	360.1	100

[1] Mitchell, K. op. cit. p. 44.

TABLE NO. 9

TAIWAN, INDUSTRIAL PRODUCTION [1]

Commodity	Unit	1936	Peak Year During War
Coal	Metric tons	1,744,000	2,800,000
Salt	Metric tons	225,000	493,000
Copper	Metric tons	6,915	6,961
Aluminium	Metric tons	200	12,204
Gold	Troy ounces	82,000	126,000
Petroleum - crude	Barrels (U.S.)	88,000	160,000
- refined	Barrels (U.S.)	--	--
Sugar - refined	Metric tons	904,000	1,400,000
Industrial Alcohol	1,000 gallons	4,800	19,000
Chemical Fertilizers	Metric tons	19,000	29,400
Paper	Metric tons	12,400	23,700
Caustic Soda	Metric tons	4,000	8,300
Bleaching Powder	Metric tons	--	940
Hydrochloric Acid	Metric tons	--	780
Textiles - Cotton Yarn	Metric tons	127	540
- Cotton Cloth	1,000 yards	1,800	2,600
- Gunny Sacks	1,000	6,000	8,500
Electric Power	1,000 kw.	497,000	1,066,000
Fish Catch	2,000 tons	93,000	129,000

Commodity	Unit	1946	1948
Coal	Metric tons	1,049,000	1,649,000
Salt	Metric tons	232,000	360,000
Copper	Metric tons	--	900
Aluminium	Metric tons	--	2,500
Gold	Troy ounces	--	12,200
Petroleum - crude	Barrels (U.S.)	--	36,000
- refined	Barrels (U.S.)	--	700,000
Sugar - refined	Metric tons	30,000	268,000
Industrial Alcohol	1,000 gallons	2,700	4,900
Chemical Fertilizers	Metric tons	4,800	38,300
Paper	Metric tons	2,900	6,500
Caustic Soda	Metric tons	950	4,800
Bleaching Powder	Metric tons	1,670	2,800
Hydrochloric Acid	Metric tons	740	3,100
Textiles - Cotton Yarn	Metric tons	410	804
- Cotton Cloth	1,000 yards	1,850	4,480
- Gunny Sacks	1,000	1,300	3,000
Electric Power	1,000 kw.	463,000	832,000
Fish Catch	2,000 tons	51,500	65,700

[1] Modified after Foreign Commerce Weekly, 12th Dec., 1949. p. 41.